2-m FM HANDHELD TRANSCEIVER

TH-215A/E

SERVICE MANUAL

KENWOOD

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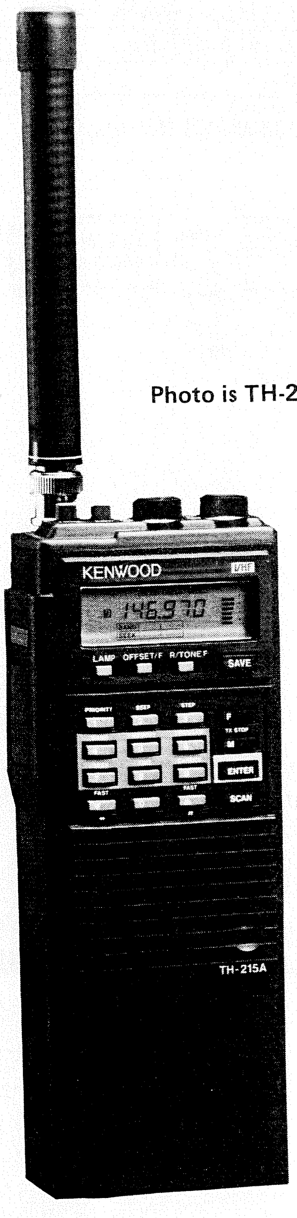
KENWOOD
146.970
LAMP
OFFSET/F
R/TONE F
SAVE
ENTER
SCAN
TH-215A

Photo is TH-215A.

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CIRCUIT DESCRIPTION

Receiver section

The basic construction of the receiver section is of the double-superheterodyne system using the first IF of 16.3 MHz and second IF of 455kHz.

The signal input to the antenna is HF amplified by Q6 : 2SC3356 and Q7 : 2SC2714 which are connected in cascade, and supplied to the BPF of L15 to L17. The output from the BPF is supplied to first mixer Q8 : 2SK210(GR) to be mixed with the first local oscillator (PLL) output signal. The first mixer output is supplied through a 16.3 MHz MCF, amplified by Q9 : 2SC2714(O), and input to IC1 : TA7761P of the IF unit as the first IF signal. The first IF signal is mixed with the 16.755MHz signal from the second local oscillator, and covered into the 455kHz second IF signal. The 455kHz second IF signal is supplied through ceramic filter CF1, amplified by an internal amp, and detected.

The detected signal is sent through the AF VOL, amplified by IC2 : BA526, and sent to the speaker.

Item	Rating
Noninal center frequency (fo)	16.3MHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	fo ± 25kHz or more at 40dB
Guaranteed attenuation	70dB or more within fo ±1MHz Spurious : 40dB or more at fo ~ fo +500kHz.
Ripple	1dB or less
Insertion loss	2dB or less
Terminal impedance	1.8kΩ//0pF

Table 1 MCF (L71-0265-05) (RF unit XF1,2)

Item	Rating
Center frequency of 6dB bandwidth (fo)	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455 ± 5kHz)
Guaranteed attenuation	27dB or more within fo ± 100kHz
Insertion loss	6dB or less at 455kHz
Terminal impedance	1.5kΩ

Table 2 Ceramic filter (L72-0335-05) (IF unit CF1)

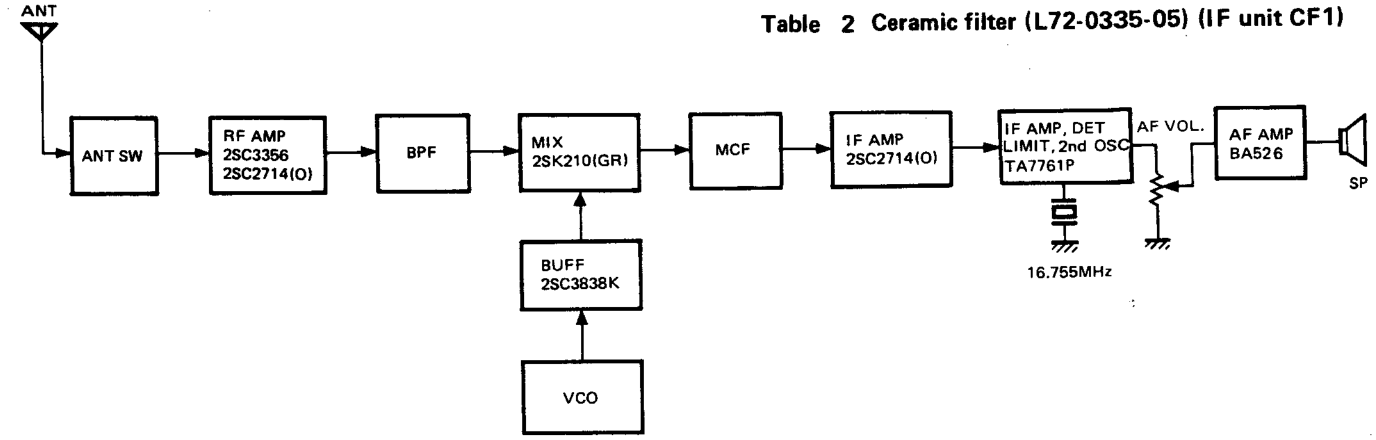


Fig. 1 RX section block diagram

Transmitter section

The audio signal from the MIC is amplified at sub-unit (X59-3090-10) (microphone amp) of the IF unit, then sent to sub-unit (X59-3010-10) (VCO) of the RF unit in order to apply direct modulation to the VCO utilizing the capacitance between the electrodes of D1 : 1SV153.

The VCO output is amplified by Q2 : 2SC3838K(N,P) and Q3 : 2SC2407, supplied through power-controller pin diode D3 : 1SV172, and power-amplified by final IC1 : M57732L.

The transmission output from IC1 is sent through low pass filter L8 and transmission/reception switching diode D5 : MI303, and supplied to the ANT terminal.

A part of the output is detected by D8 and D9 : HSM88AS. It is used by Q4 : 2SA1313(Y) and Q5 : FMW1 to control the current flowing to D3 and to apply APC by varying the power driving IC1. The power adjustment is performed by VR1 and VR2 on the IF unit.

CIRCUIT DESCRIPTION

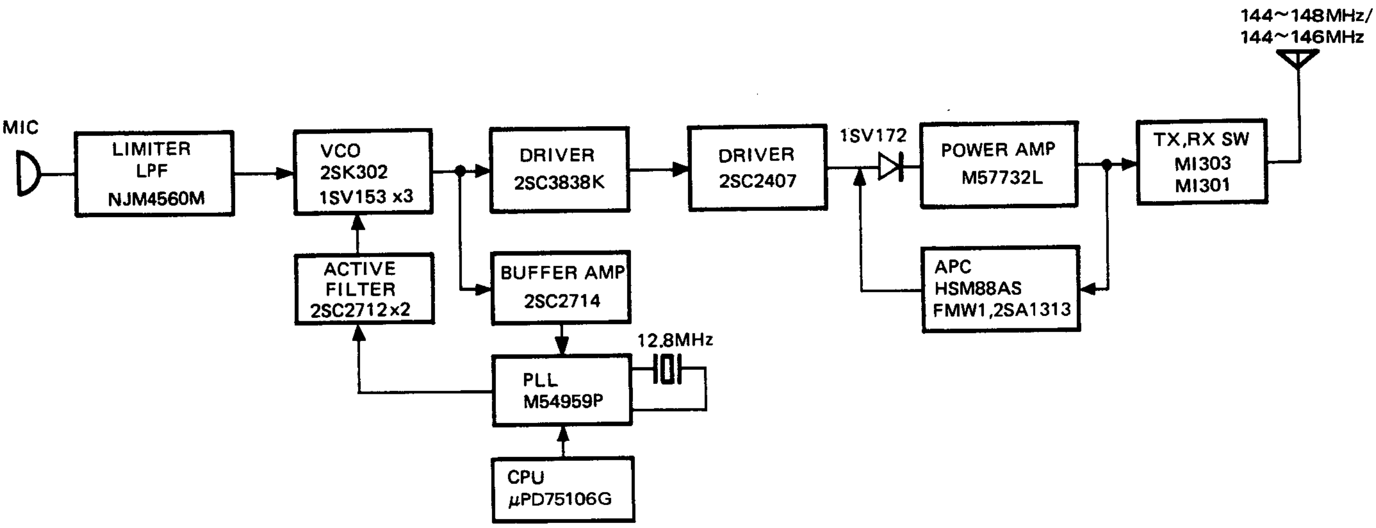

144~148MHz/
144~146MHz
MIC
LIMITER
LPF
NJM4560M
VCO
2SK302
1SV153 x3
DRIVER
2SC3838K
DRIVER
2SC2407
1SV172
POWER AMP
M57732L
TX,RX SW
MI303
MI301
ACTIVE
FILTER
2SC2712x2
BUFFER AMP
2SC2714
APC
HSM88AS
FMW1,2SA1313
12.8MHz
PLL
M54959P
CPU
μPD75106G

Fig. 2 TX section block diagram

PLL unit

The VCOs are provided independently for transmission and reception, and use Colpitts oscillator circuits of Q1 and Q2 : 2SK302(GR). The two VCOs are switched by switching Q11 using the serial data sent from the microprocessor PLL control IC2 : M54959P.

The VCO output is distributed to the transmitter, receiver and PLL. The signal supplied to the PLL circuit is input to IC2 via the buffer circuit of Q1 : 2SC2714(O). The VCO output, which is input to IC2, is divided with the dividing ratio set by the serial data from the microprocessor. On the other hand, its phase is compared with that of a 5kHz signal obtained by dividing X1 : 12.8MHz, and the result is output from pin 9 of IC2. The phase comparison output passes through the active filter of Q12 of Q13 : 2SC2712(GR) and controls the VCO.

If the PLL is unlocked during transmisison and the UL line from the RF unit goes high (HI), the microprocessor turns the TX line to low (LO) and returns to the transmission mode preventing abnormal reception.

Power supply circuit

The TH-215 provides the following regulated/unregulated voltages;

T5 . . . . 5V DC in transmit
R5 . . . . 5V DC in receive
C5 . . . . 5V DC constant
M5 . . . . 5V DC for the microphone
VDD . . . . . 5V DC for microprocessor bias
KEY . . . . . Key matrix voltage
CB . . . . Battery voltage

The C5 constant voltage circuit utilizes three-pin regulators IC5 : LVC550C, Q14 : 2SA1358Y and Q15 : FMW1.

The T5 circuit consisting of Q13 : 2SA1313(Y) and Q16 : DTC114YK is controlled by the TX line from the microprocessor.

The R5 circuit, Q11 : DTA114YK and Q12 : DTA144EK is controlled by the output of the T5 circuit.

The M5 and KEY lines are directly controlled by three-pin regulator IC5.

VDD utilizes the output of the three-pin regulator IC4 : LVC550C to provide microprocessor power. When IC4 is OFF, D6 : 1SS184 causes the microprocessor to be powered from the backup battery, B1.

Since the microprocessor must synthesize TTP information and sub audible tone information the clock frequency is higher than the clock in the TH-205. Therefore, 5V is about 0.7V DC higher in the TH-215, by putting the GND terminal of IC4 higher at D7 : 1SS226.

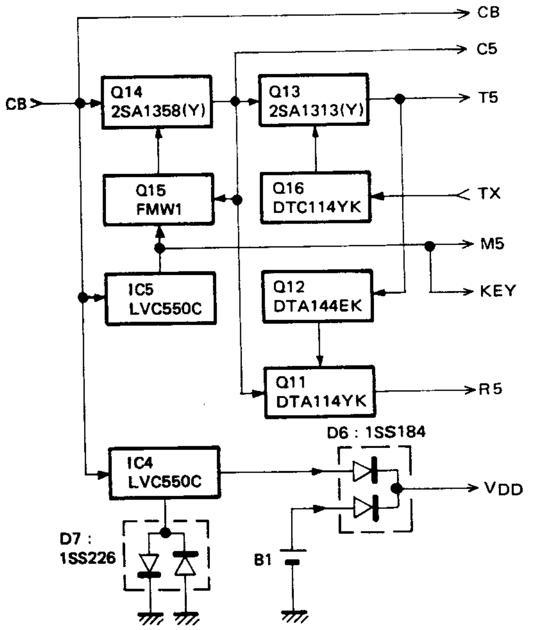

CB
C5
CB
Q14
2SA1358(Y)
Q13
2SA1313(Y)
T5
Q15
FMW1
Q16
DTC114YK
TX
M5
IC5
LVC550C
Q12
DTA144EK
KEY
Q11
DTA114YK
R5
D6 : 1SS184
IC4
LVC550C
VDD
D7 :
1SS226
B1

Fig. 3 Power supply circuit

CIRCUIT DESCRIPTION

Microprocessor and its peripheral circuits

The TH-215 is designed for multiple functions and has low power consumption, thanks to its 4 bit single-chip microprocessor (IC1 : µPD75106G-514-1B in the control section) and LCD driver (IC2, a µPD7225G in the Case ass'y).

- **Backup circuits**

If the CB voltage drops to approximately 5V, pin 1 of IC3 : S-8045HN in the IF unit goes "L" and pin 44 of the microprocessor goes "L". This places the microprocessor in the backup mode. If the CB voltage returns to normal, pin 44 of the microprocessor goes "H" and places the microprocessor back in the normal operating mode. This causes a differenting circuit to apply a reset pulse to pin 7 of the microprocessor.

Normally, the microprocessor can be reset by grounding pin 7 or pin 44. However, when the microprocessor lithium backup battery fails or when a new battery is installed the microprocessor must be reset by applying a pulse to pin 7.

Pin 44 is used to reset the microprocessor when normal reset is impossible, due to low input voltage or a short power outage. If this happens the microprocessors RAM contents will be maintained by the lithium battery.

- **Squelch circuit**

Incoming signals are detected by IC1 : TA7761P (in the IF section) then amplified, rectified, and smoothed by the filter formed by IC1 and Q2 : 2SC2712(GR). The squelch control (SQL VOL.) sets the control voltage on Q1 : 2SC2712(GR). When Q1 is ON, the incoming receive signal is applied to the SQ port (pin 36) of the microprocessor.

When a signal is received, port SQ goes "H" and the BUSY indicator turns ON, in the LCD. At the same time, port AFC (pin 39 of the microprocessor) become "L" and Q6 thru Q8 (Q6 : FMG2, Q7 : 2SC2712(GR), Q8 : 2SA 1241Y) of the IF unit, apply power to IC2 and Q6. When power is supplied to IC2, squelch is disabled. Pushing the MONITOR button places the SQ line "H" and the AFC line "L", this also opens squelch.

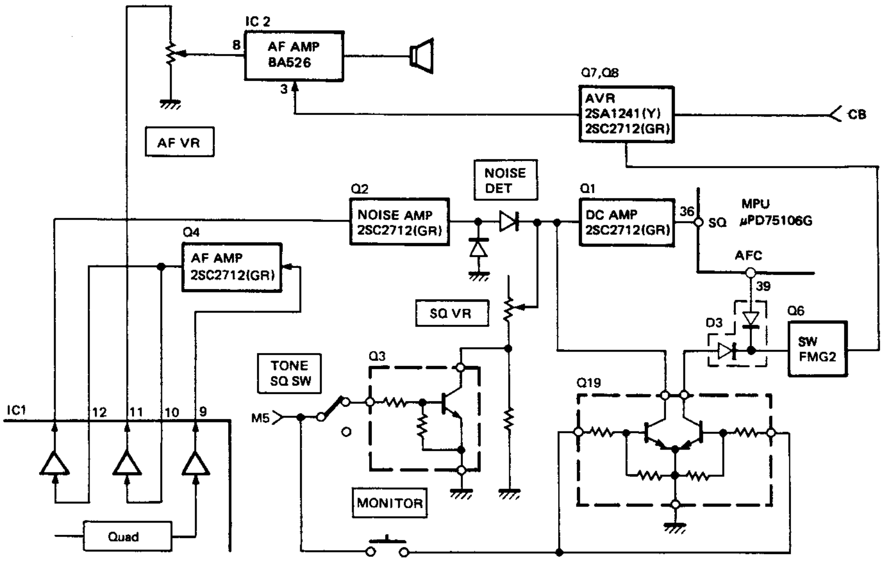
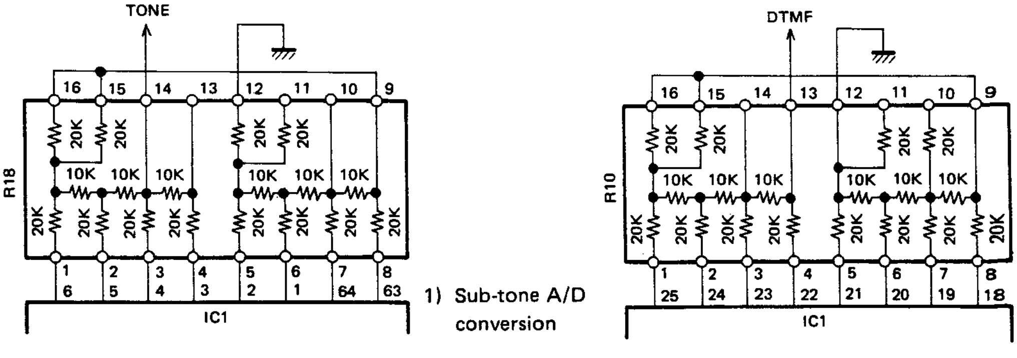

IC 2
8
AF AMP
BA526
3
Q7,Q8
AVR
2SA1241(Y)
2SC2712(GR)
CB
AF VR
NOISE DET
Q2
NOISE AMP
2SC2712(GR)
Q1
DC AMP
2SC2712(GR)
36
SQ
MPU
µPD75106G
AFC
39
Q4
AF AMP
2SC2712(GR)
D3
Q6
SW
FMG2
SQ VR
TONE
SQ SW
Q3
Q19
IC1
12
11
10
9
M5
MONITOR
Quad

Fig. 4 Squelch circuit

- **Sub-tone and touch tone signals.**

Sub audible tone frequencies and Touch Tone Pad frequencies are generated by the microprocessor in the TH-215. Since sub audible tones are a single tone the sine wave is produced from 7-bit digital data supplied by the microprocessor. Digital to analog conversion (D/A) is performed by weighted resistor array R18.

Touch tone signals are a two frequency signal produced by combining two 7-bit sine waves to an 8-bit signal. Digital to analog conversion is performed by weighted resistor array R10 for this function.


TONE
16
15
14
13
12
11
10
9
R18
20K
10K
1
2
3
4
5
6
7
8
6
5
4
3
2
1
64
63
IC1
DTMF
R10
25
24
23
22
21
20
19
18

1) Sub-tone A/D conversion

2) Touch tone A/D conversion

Fig. 5 Sub-tone and touch-tone signals

CIRCUIT DESCRIPTION/SEMICONDUCTOR DATA

- **Battery power save circuit**

The TH-215 provides several battery saver modes to conserve on battery power. These modes function during the receive mode and not the transmit mode.

1) Save mode

In this mode the radio will activate the battery power save circuit 2 seconds after the squelch closes.

2) Auto save mode

In this mode the radio will activate the battery power save circuit 1 minute after the last key operation during the receive mode.

To select the desired battery saver mode press the SAVE key. Each time the key is depressed you will step thru the various modes, i.e. for SAVE to AUTO SAVE to OFF and back to SAVE etc. The appropriate indicator will light in the display to remind you which circuit is active. When no indicator is on the battery power save circuit is OFF.

3) Power save ratio selection

In addition to the two different activation modes the TH-215 allows you to specify the actual length of time the receiver section shuts down. To alter this rate press the F and then the SAVE key. The display will show the time the radio will be operating at reduced power levels.

During battery saver operation the SAVE line (pin 37) of the microprocessor repeatedly cycles between a logic "H" : High and "L" : Low which turns C5 and R5 ON and OFF. The VDD, KEY and M5 lines are not affected by these circuits and remain active. The ON/OFF interval is adjustable between 1 and 9 units, with each unit equalling about 200msec.

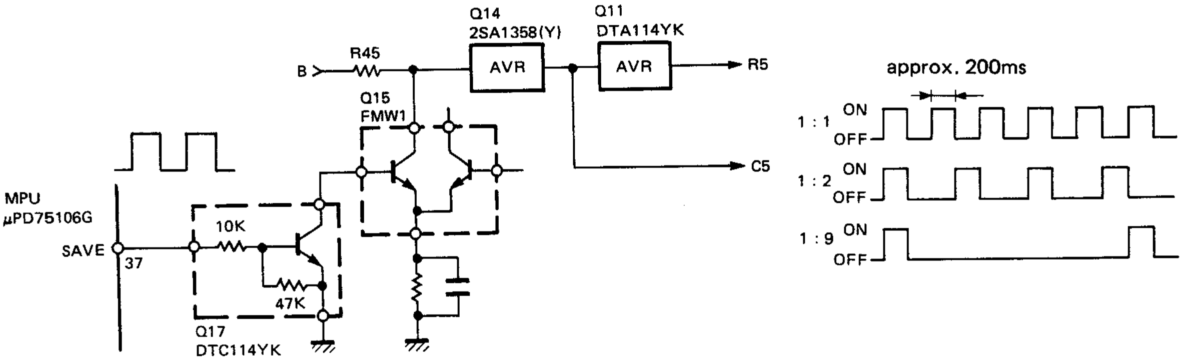
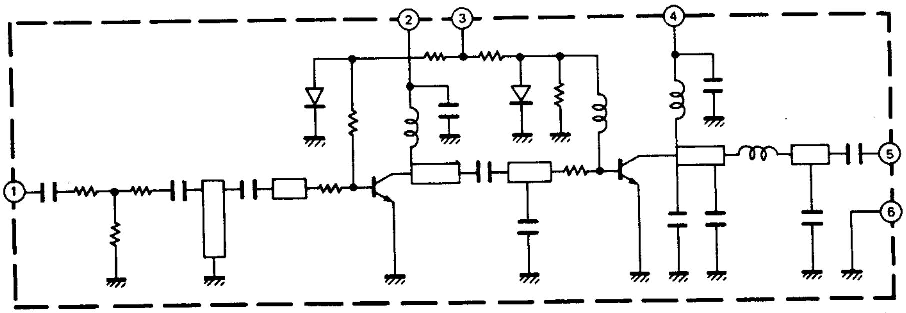


Fig. 6 Battery power save circuit

RF POWER AMP M57732L(RF UNIT IC1)

- **Equivalent circuit**



1:INPUT
2:PRE-DRIVE+B
3:BIAS+B
4:FINAL+B
5:OUTPUT
6:GND

- **Electrical characteristic**

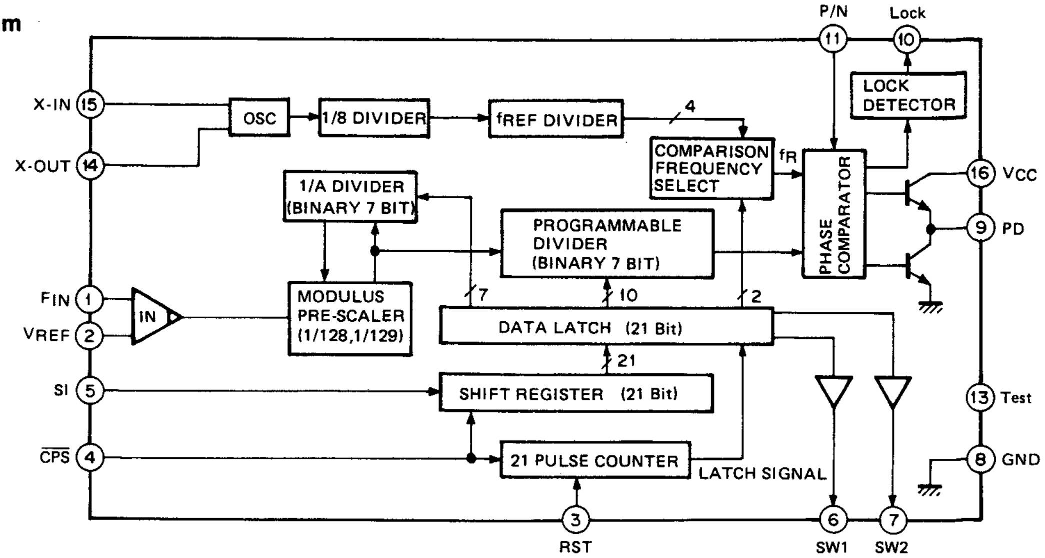
Item	Symbol	Rating			Unit	Condition
		Min	Max	Typ		
Output power	P_{o1}	7	8	–	W	Vcc = 12.5V
Total efficiency	ηT	40	45	–	%	Vcc = 12.5V
2nd spurious		–	–	−20	dB	Vcc = 12.5V
Spurious after 3rd		–	–	−30	dB	Vcc = 12.5V
Input SWR	δin	–	1.5	2.5	–	Vcc = 12.5V
Output SWR	δout	–	1.5	–	–	Vcc = 12.5V
Output power	P_{o2}	5	6	–	W	Vcc = 10.8V
Output power	P_{o3}	3.5	4	–	W	Vcc = 8.4V
Output power	P_{o4}	1.5	2	–	W	Vcc = 7.2V

($T_a = 25$℃、$V_{BB} = 5V$、f = 135 ~ 160MHz、$P_{in} = 20mW$、$Z_G = Z_L = 50\Omega$)

SEMICONDUCTOR DATA

PLL M54959P(RF UNIT IC2)

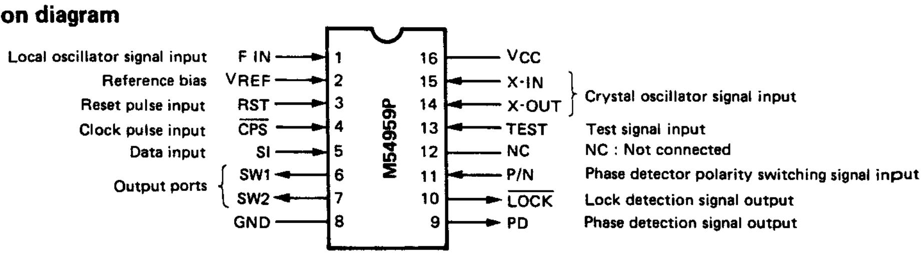
- **Block diagram**


P/N
Lock
11
10
LOCK DETECTOR
X-IN 15
X-OUT 14
OSC
1/8 DIVIDER
fREF DIVIDER
4
COMPARISON FREQUENCY SELECT
fR
PHASE COMPARATOR
16 VCC
9 PD
1/A DIVIDER (BINARY 7 BIT)
PROGRAMMABLE DIVIDER (BINARY 7 BIT)
FIN 1
VREF 2
IN
MODULUS PRE-SCALER (1/128,1/129)
7
10
2
DATA LATCH (21 Bit)
21
SI 5
SHIFT REGISTER (21 Bit)
13 Test
$\overline{CPS}$ 4
21 PULSE COUNTER
LATCH SIGNAL
8 GND
3
RST
6
SW1
7
SW2

- **Description of terminals**

No.	Symbol	Pin name	Description
1	F_{IN}	Local oscillator signal input	Local oscillator frequency (VCO input; f_{MAX} = 500MHz).
2	V_{REF}	Reference bias	Grounded by a 1000pF capacitor.
3	RST	Reset pulse input	Reset pulse input for 21-pulse counter.
4	$\overline{CPS}$	Clock pulse input	Clock pulse input for shift register.
5	SI	Data input	Data input for shift register.
6	SW1	Output ports	Output ports whose status is determined by the data sent from the controller.
7	SW2		Open collector.
8	GND	Ground	0V.
9	PD	Phase detection signal output	Tristate.
10	$\overline{LOCK}$	Lock detection signal output	"L" when the PLL unit is locked; "H" when it is unlocked. Open collector.
11	P/N	Phase detector polarity switching	When this pin is "H", the PD pin is "H" for phase lead and "L" for phase delay. When this pin is "L", the PD pin is "L" for phase lead and "H" for phase delay.
12	NC	Not connected	Used open or as ground.
13	Test	Test signal input	Usually "L". When this pin is "H", f_R (comparison frequency) and f_{IN}/N (programmable divider) are output from SW1 (pin 6) and SW2 (pin 7), respectively.
14	X-OUT	Liquid crystal oscillator signal input	Inputs signals sent from the 12.8MHz basic oscillator to X-IN.
15	X-IN		Oscillation is possible even when an external crystal resonator is used.
16	Vcc	Power supply	4.5~5.5V.

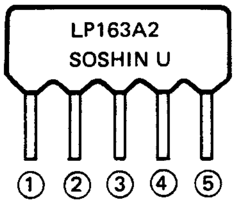
- **Terminal connection diagram**


Local oscillator signal input
F IN
1
Reference bias
VREF
2
Reset pulse input
RST
3
Clock pulse input
$\overline{CPS}$
4
Data input
SI
5
Output ports
SW1
6
SW2
7
GND
8
M54959P
16
VCC
15
X-IN
14
X-OUT
Crystal oscillator signal input
13
TEST
Test signal input
12
NC
NC : Not connected
11
P/N
Phase detector polarity switching signal input
10
$\overline{LOCK}$
Lock detection signal output
9
PD
Phase detection signal output

SEMICONDUCTOR DATA

LPF LP163A2(RF UNIT L8)

- **Outside view**


LP163A2
SOSHIN U
①
②
③
④
⑤

1:INPUT
2:GND
3:GND
4:GND
5:OUTPUT

- **Electrical characteristic**

Item	Rating
Input and output impedance	50Ω
Pass bandwidth	142–163MHz
Loss	0.7dB or less
V.S.W.R.	1.5 or less
Attenuation	35dB or more (284–500MHz)

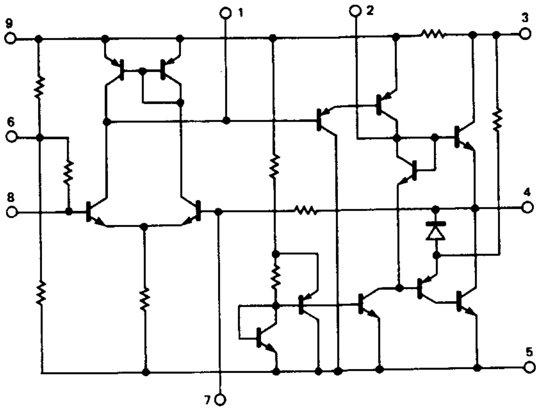
AF POWER AMP BA526(IF UNIT IC2)

- **Electrical characteristic**

Item	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
DC current	I_{CC}	–	12	24	mA	V_{IN} = 0V
Voltage gain	Gvc	48	52	54	dB	R_{NF} = 47Ω, V_{IN} = 2.5mV
Max. output power	Po MAX	600	700	–	mW	V_{IN} = 25mV
Spec. output power	Po	350	430	–	mW	T.H.D. = 10%
Noise output voltage	V_{NO}	–	0.25	0.7	mV	Rg = 0Ω
Distortion	T.H.D.	–	0.4	2	%	Po = 50mW
Input resistance	Z_{IN}	–	22	–	kΩ	1kHz Po = 50mW

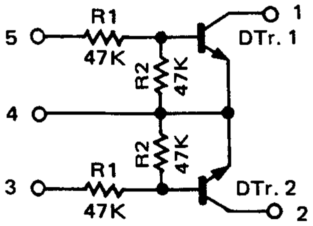
(Ta=25℃、V_{CC}=6V、R_L=8Ω、f=1kHz)

- **Equivalent circuit**



FMG2 (IF UNIT Q6,10,19)

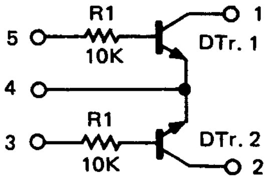
- **Equivalent circuit**


R1
47K
R2
47K
R2
47K
R1
47K
DTr. 1
DTr. 2
1
2
3
4
5

1: Tr1 OUT
2: Tr2 OUT
3: Tr2 IN
4: GND
5: Tr1 IN

FMG4 (RF UNIT Q11,14)

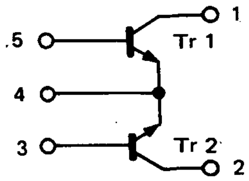
- **Equivalent circuit**


R1
10K
R1
10K
DTr. 1
DTr. 2
1
2
3
4
5

1: Tr1 OUT
2: Tr2 OUT
3: Tr2 IN
4: GND
5: Tr1 IN

FMW1 (IF UNIT Q15, RF UNIT Q5)

- **Equivalent circuit**


Tr 1
Tr 2
1
2
3
4
5

1: Tr1 Collector
2: Tr2 Collector
3: Tr2 Base
4: Tr1, 2 Emitter
5: Tr1 Base

SEMICONDUCTOR DATA

μPD75106G-514-1B (Case ass'y IC1)

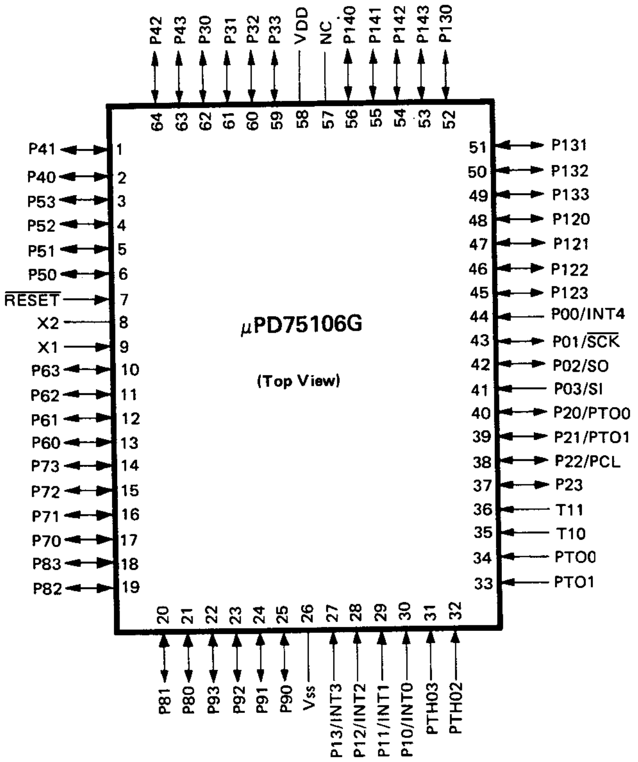
- **Terminal functions**

Pin No.	Port name	I/O	Name	Function
1	P41	O		TONE bit 5, 1750 **(T,W only)**
2	P40	O		TONE bit 4, 1750 **(T,W only)**
3	P53	O		TONE bit 3, 1750 **(T,W only)**
4	P52	O		TONE bit 2, 1750 **(T,W only)**
5	P51	O		TONE bit 1.
6	P50	O		TONE bit 0.
7	$\overline{\text{RESET}}$	I		Reset.
8	X2	O		X'tal oscillator.
9	X1	I		X'tal oscillator.
10	P63	–		Not used.
11	P62	O	TRS	Power supply for TONE SQL unit, "H" : Power ON, "L" : Power OFF.
12	P61	I		μPD7225G $\overline{\text{RESET}}$.
13	P60	O		μPD7225G $\overline{\text{BUSY}}$.
14	P73	O		μPD7225G C/$\overline{\text{D}}$.
15	P72	O		μPD7225G CS.
16	P71	O		μPD7225G SI.
17	P70	O		μPD7225G $\overline{\text{SCK}}$.
18	P83	O		DTMF bit 7.
19	P82	O		DTMF bit 6.
20	P81	O		DTMF bit 5.
21	P80	O		DTMF bit 4.
22	P93	O		DTMF bit 3.
23	P92	O		DTMF bit 2.
24	P91	O		DTMF bit 1.
25	P90	O		DTMF bit 0.
26	Vss	–		GND.
27	P13/INT3	I	J4	Customer's pin.
28	P12/INT2	I	J3	Customer's pin.
29	P11/INT1	I	J2	Customer's pin.
30	P10/INT0	I	J1	Customer's pin.
31	PTH03	–		Not used.
32	PTH02	–		Not used.
33	PTH01	I		Battery warning, analog input.
34	PTH00	I	SM	S meter, analog input.
35	TI0	I	UL	"H" : PLL Unlocked, "L" : PLL Locked.
36	TI1	I	SQ	"H" : SQ Close.
37	P23	O	SAVE	OPEN : Power Save operation, "L" : NORMAL operation.
38	P22/PCL	O	TX	"H" : TX, "L" : RX, OPEN Power Save operation.
39	P21/PT01	O	BEEP	BEEP sound output.
40	P20/PT00	O	AFC	"H" : SP OFF, "L" : SP ON, OPEN Power Save operation.
41	P03/SI	–		Not used.
42	P02/SO	O	TD	DATA for TONE SQL unit.
43	P01/$\overline{\text{SCK}}$	O	TCK	CLOCK for TONE SQL unit.
44	P00/INT4	I	BU	"H" : Normal operation, "L" : Backup operation switching.
45	P123	–		Not used.
46	P122	I	TS	"H" : TONE OFF, "L" : TONE ON.
47	P121	I	ST	"H" : PTT OFF, "L" : PTT ON.
48	P120	I		Key matrix (DOWN, 0, UP, SCAN).
49	P133	I		Key matrix (7, 8, 9, ENTER).
50	P132	I		Key matrix (4, 5, 6, M).
51	P131	I		Key matrix (1, 2, 3, F).
52	P130	I		Key matrix (OFFSET, REV, SAVE).
53	P143	O		Key matrix (SAVE, M, F, ENTER, SCAN).
54	P142	O		Key matrix (REV, 3, 6, 9, UP).
55	P141	O		Key matrix (OFFSET, 2, 5, 8, 0).
56	P140	O		Key matrix (1, 4, 7, DOWN).
57	NC	–		Not used.
58	VDD	–	VDD	Power supply (+ 5V).
59	P33	–		Not used.
60	P32	O	$\overline{\text{CPS}}$	CLOCK for PLL IC.
61	P31	O	SI	DATA for PLL IC.
62	P30	O	RST	RESET for PLL IC.
63	P43	O		Tone bit 7, 1750 **(T,W only)**
64	P42	O		Tone bit 6, 1750 **(T,W only)**

SEMICONDUCTOR DATA

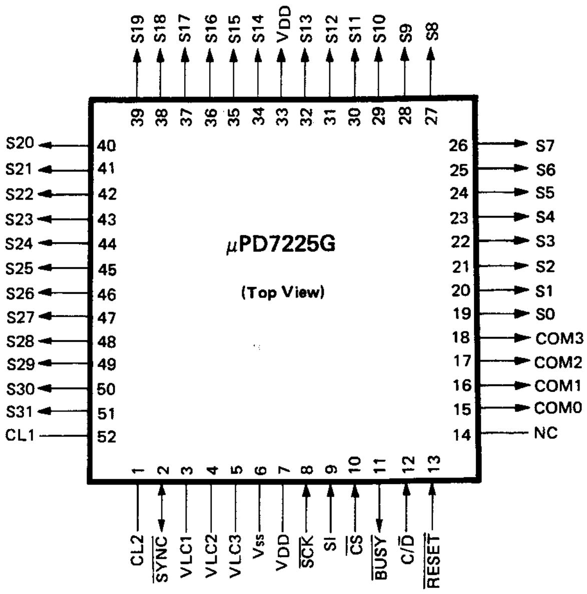
μPD75106G-514-1B (Case ass'y IC1)

- **Terminal connection diagram**


μPD75106G
(Top View)
64 P42
63 P43
62 P30
61 P31
60 P32
59 P33
58 VDD
57 NC
56 P140
55 P141
54 P142
53 P143
52 P130
1 P41
2 P40
3 P53
4 P52
5 P51
6 P50
7 $\overline{RESET}$
8 X2
9 X1
10 P63
11 P62
12 P61
13 P60
14 P73
15 P72
16 P71
17 P70
18 P83
19 P82
51 P131
50 P132
49 P133
48 P120
47 P121
46 P122
45 P123
44 P00/INT4
43 P01/$\overline{SCK}$
42 P02/SO
41 P03/SI
40 P20/PTO0
39 P21/PTO1
38 P22/PCL
37 P23
36 T11
35 T10
34 PTO0
33 PTO1
20 P81
21 P80
22 P93
23 P92
24 P91
25 P90
26 Vss
27 P13/INT3
28 P12/INT2
29 P11/INT1
30 P10/INT0
31 PTH03
32 PTH02

μPD7225G (Case ass'y IC2)

- **Terminal connection diagram**


μPD7225G
(Top View)
39 S19
38 S18
37 S17
36 S16
35 S15
34 S14
33 VDD
32 S13
31 S12
30 S11
29 S10
28 S9
27 S8
40 S20
41 S21
42 S22
43 S23
44 S24
45 S25
46 S26
47 S27
48 S28
49 S29
50 S30
51 S31
52 CL1
26 S7
25 S6
24 S5
23 S4
22 S3
21 S2
20 S1
19 S0
18 COM3
17 COM2
16 COM1
15 COM0
14 NC
1 CL2
2 $\overline{SYNC}$
3 VLC1
4 VLC2
5 VLC3
6 Vss
7 VDD
8 $\overline{SCK}$
9 SI
10 $\overline{CS}$
11 $\overline{BUSY}$
12 C/$\overline{D}$
13 $\overline{RESET}$

μPD7225G (Case ass'y IC2)

- **Terminal functions**

Pin No.	Pin name	Function
1	CL2	R connection for CLOCK signal generation.
2	$\overline{SYNC}$	Not used.
3	VLC1	LCD driver power supply.
4	VLC2	LCD driver power supply.
5	VLC3	LCD driver power supply.
6	Vss	GND.
7	VDD	Power supply.
8	$\overline{SCK}$	Serial clock input.
9	SI	Serial data output.
10	$\overline{CS}$	Chip select input.
11	$\overline{BUSY}$	BUSY output.
12	C/$\overline{D}$	Command/Data select input.
13	$\overline{RESET}$	Reset input.
14	NC	Not used.
15	COM0	Common signal output
16	COM1	Common signal output.
17	COM2	Common signal output.
18	COM3	Common signal output.
19~32	S0~S13	Segment signal output.
33	VDD	Not used.
34~51	S14~S31	Segment signal output.
52	CL1	R connection for CLOCK signal generation.

DESCRIPTION OF COMPONENTS

RF UNIT (X44-3000-10)

Component	Name	Function
IC1	M57732L	Transmission power amplification.
IC2	M54959P	PLL.
Q1	2SC2714(O)	VCO output amplifier.
Q2	2SC3838K(N,P)	Transmission amplifier.
Q3	2SC2407	Transmission amplifier.
Q4	2SA1313(Y)	Current control for D3.
Q5	FMW1	APC.
Q6	2SC3356	RF amplifier for reception.
Q7	2SC2714(O)	RF amplifier for reception.
Q8	2SK210(GR)	1st mixer for reception.
Q9	2SC2714(O)	1st IF amplifier for reception.
Q10	2SC3838K(N,P)	HFT (VCO) amplifier.
Q11	FMG4	Varicap tuning voltage control.
Q12,Q13	2SC2712(GR)	Active filter.
Q14	FMG4	VCO power supply switching for transmission and reception.
D1	HSM2693	Transmission/reception switching.
D2	DA204K	Q3 bias setting.
D3	1SV172	Control on RF signal input to final module.
D4	DA204K	Q5 bias setting.
D5	MI303	Transmission/reception switching (Transmission : ON).
D6	MI301	Transmission/reception switching (Transmission : ON).
D7	1SS277	Protection of receiving unit against excessive input.
D8,D9	HSM88AS	APC detection.
D10~D13	1SV153	Varicap tuning.
D14	ERB83-004	Protection against reverse connection.
D15	UZP-22B	Protection against over-voltage.
D16	ERB83-004	Battery protection for the external DC power supply operation.

IF UNIT (X48-3020-XX)

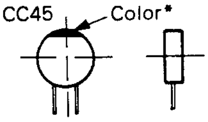
-10 : K,M1,M2,X (TH-215A), -51 : T,W (TH-215E)

Component	Name	Function
IC1	TA7761P	1st IF amplifier receiver, 2nd OSC, 2nd MIX, 2nd IF amplifier, DISC. ⑦S meter output, ⑨Detection signal output, ⑪AF amplifier output, ⑬Noise amplifier output, ⑯IF signal input.
IC2	BA526	AF power amplifier ④output, ⑧input.
IC3	S-8054HN	Backup reset ① output ("H" → "L" Backup).
IC4	LVC550C	Microprocessor power supply ①input, ③output.
IC5	LVC550C	KEY, 5V AVR for M5, ① input, ③output.
Q1	2SC2712(GR)	SQL SW, BUSY : OFF.
Q2	2SC2712(GR)	SQL noise amplifier.
Q3	DTC144EK	SQL AUTO/MANUAL SW.
Q4	2SC2712(GR)	AF amplifier.
Q5	2SJ106(GR)	Hysteresis characteristic switching for SQL circuit, BUSY : ON.
Q6	FMG2	SW : ①Turns OFF the MIC input when sound is generated from SP while transmitting (when DTMF, BEEP, etc., output). ②Turns OFF the AF amplifier power supply when AFC is "H". **K,M1,M2,X only**
Q7	2SC2712(GR)	AF amplifier power supply.
Q8	2SA1241(Y)	AF amplifier power supply.
Q9	DTC143XK	BEEP sound amplifier.
Q10	FMG2	SW : ① Turns SPL "L" when using DTMF while transmitting with TONE SQL unit. ②Turns the line for MOD pin "L" to cut the microprocessor noise while receiving.
Q11	DTA114YK	R5 power supply SW.
Q12	DTA144EK	R5 power supply SW.
Q13	2SA1313(Y)	T5 power supply SW.
Q14	2SA1358(Y)	C5 power supply.
Q15	FMW1	C5 power supply.
Q16	DTC114YK	T5 power supply SW.
Q17	DTC114YK	SW : Turns C5 ON/OFF in SAVE mode.
Q18	DTC114YK	SW : Turns SQ pin "L" in SAVE (C5 OFF) mode.
Q19	FMG2	SW : Forces SQL open when monitoring.
Q20	DTC144EK	SW : Turns MIC input OFF when transmitting DTMF. **K,M1,M2,X only**
D1	HSM88AS	SQL noise rectification.
D3	1SS184	SW : Power supply for AF amplifier, AFC, OR circuit for SPO.
D4	02CZ8.2	AVR
D5	02CZ8.2	AVR
D6	1SS184	SW : Switching for microprocessor power supply.
D7	1SS226	AVR voltage shift (approx. 0.6V).

PARTS LIST

CAPACITORS CC 45 TH 1H 220 J
1 2 3 4 5 6

1 = Type ...... ceramic, electrolytic, etc. 4 = Voltage rating
2 = Shape ......round, square, etc. 5 = Value
3 = Temp. coefficient 6 = Tolerance



- **Capacitor value**

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF
1 0 3 = 0.01μF

2 2 0 = 22pF
1st number | Multiplier
2nd number

- **Temperature Coefficient**

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	−80	−150	−220	−330	−470	−750

2nd Word	G	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = −470±60 ppm/°C

- **Tolerance**

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+ 40 −20	+ 80 −20	+ 100 −0	More than 10μF−10~+50 Less than 4.7μF−10~+75

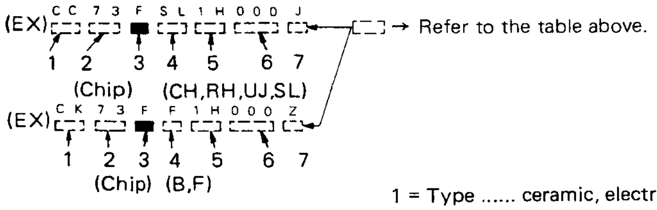
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

- **Rating voltage**

2nd word / 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	–
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	–
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	–

- **Chip capacitors**


(EX)
C C 7 3 F S L 1 H 0 0 0 J
1 2 3 4 5 6 7
(Chip)
(CH,RH,UJ,SL)
Refer to the table above.
(EX)
C K 7 3 F F 1 H 0 0 0 Z
1 2 3 4 5 6 7
(Chip)
(B,F)

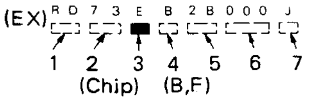
1 = Type ...... ceramic, electrolytic, etc.
2 = Shape ...... round, square, etc.
3 = Dimension
4 = Temp. coefficient
5 = Voltage rating
6 = Value
7 = Tolerance.

Dimension

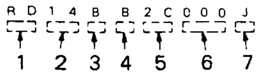
Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

RESISTORS

- **Chip resistor (Carbon)**


(EX)
R D 7 3 E B 2 B 0 0 0 J
1 2 3 4 5 6 7
(Chip)
(B,F)

- **Carbon resistor (Normal type)**


R D 1 4 B B 2 C 0 0 0 J
1 2 3 4 5 6 7

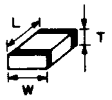
Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1 /10W	2E	1/ 4W	3A	1W
2B	1/ 8W	2H	1/ 2W	3D	2W
2C	1/ 6W				

Dimension



PARTS LIST

SEMICONDUCTOR

N : New parts

Item	Re-marks	Parts No.
Diode	N	1SS277
		ERB83-004
		MI301
		MI303
Vari-cap		1SV153
Chip Diode		1SS184
		1SS226
	N	1SV172
		DA204K
		HSM88AS
	N	HSM2693
Zener Diode		UZP-22B
Chip Zener Diode	N	02CZ8.2
Thermister		112-101-2
		112-202-2
Posistor		PTH59T103M
TR		2SA1241(Y)
		2SA1358(Y)
	N	2SB1182F5(Q)
		2SC2407
Chip TR		2SA1313(Y)
	N	2SC2412K
		2SC2712(GR)
		2SC2714(O)
		2SC3356
	N	2SC3838K(N,P)
Digital TR		DTA114YK
		DTA144EK
		DTC114YK
		DTC144EK
		DTC143XK
		FMG2
	N	FMG4
		FMW1
Chip FET		2SK210(GR)
		2SK302(GR)
		2SJ106(GR)
IC		BA526
		LVC550C
	N	M54959P
	N	M57732L
	N	NJM4560M
		S-8054HN
		TA7761P
		µPD75106G-514-1B
		µPD7225G

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
TH-215A/E						
1	3B	*	A01-1018-15	CASE		
2	3D		A02-0728-13	BATTERY CASE ASSY	M1M2	
5	1A	*	A02-0761-05	CASE ASSY	K	
5	1A	*	A02-0762-05	CASE ASSY	M1X	
5	1A	*	A02-0763-05	CASE ASSY	M2	
5	1A	*	A02-0765-05	CASE ASSY	TW	
7	3A	*	A20-2612-14	PANEL ASSY	KM1M2X	
7	3A	*	A20-2613-14	PANEL ASSY	TW	
8	2A		A22-0749-13	SUB PANEL		
10	3B		A40-0620-13	BOTTOM PLATE		
14	3C		B09-0307-14	CAP (ACSY)		
17	3A		B40-3687-04	MODEL NAME PLATE	KM1M2X	
17	3A	*	B40-3689-04	MODEL NAME PLATE	TW	
18	1D	*	B50-8120-10	INSTRUCTION MANUAL		
19	1D		B46-0410-10	WARRANTY CARD	K	
20	1D		B58-0682-04	CAUTION CARD	M1M2	
-		*	B42-2437-04	LABEL		
-		*	B42-2454-04	LABEL		
C42			CC45SL1H180J	CERAMIC 18PF J		
20	3B		D10-0602-04	LEVER (BATTERY RELEASE		
22	2B		E23-0474-14	TERMINAL (BATT)		
23	3B		E23-0432-04	TERMINAL		
29	2A	*	E31-3209-05	CONNECTING WIRE(DC LINE)		
30	2A		E40-5089-05	PIN CONNECTOR (24P)		
-			E31-3207-08	FLAT CABLE (15P)		
-		*	E31-3210-05	CONNECTING WIRE(JIG FOR ADJ)		
-			E31-3211-08	FLAT CABLE (10P)		
J1	2A		E11-0420-15	MIC JACK		
J2	2A		E11-0421-05	PHONE JACK		
J3	2A		E03-0165-05	DC IN JACK		
J4	2A		E04-0160-05	BNC RECEPTACLE		
32	2B		F19-0646-04	BLIND PLATE		
34	1A		F20-0521-04	INSULATING SHEET(BATT,-)		
35	3A		F20-0574-04	INSULATING SHEET(CASE)		
36	1A		F20-0520-04	INSULATING BOARD(BATT,+)		
37	2B		F20-0575-04	INSULATING SHEET(VCO)		
40	3B		G01-0833-04	COIL SPRING		
41	3A		G01-0834-04	COIL SPRING		
43	2A		G10-0644-04	FELT (AF,SQL VR)		
44	2B		G11-0617-04	CUSHION (FOR BATT TERMINAL		
46	3A		G13-0846-04	CUSHION (FOR BLIND PLATE)		
47	2A		G13-0814-04	CUSHION		
48	2C	*	H01-8051-02	ITEM CARTON BOX(TH-215A)	KM1M2X	
48	2C	*	H01-8053-02	ITEM CARTON BOX(TH-215E)	W	
49	1D		H21-0713-04	PROTECTION SHEET		
50	1D		H11-0808-14	BUFFER(TOP) 215X153X13		
51	3D		H11-0809-04	BUFFER (20X68X10)		
52	1C,3C		H13-0801-04	BUFFER		
53	2D		H25-0103-04	BAG (125X250)		
54	3D		H10-2618-02	POLYSTYRENE FOAMED FIXTURE		

E: Scandinavia & Europe **K**: USA **P**: Canada **W**:Europe
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55	2D		H25-0116-04	BAG	(80X180)	K	
56	1C,2C		H25-0120-04	BAG	(150X150)	KXTW	
57	3C		H25-0076-03	BAG	(60X50)		
58	2D		J29-0417-14	BELT HOOK		K	
-			J21-4217-04	MOUNTING HARDWARE			
62	1A		K01-0414-04	HANDLE			
63	2A	⁎	K23-0787-04	KNOB	(AF VOL,SQL)		
64	3A		K27-0494-04	KNOB	(TONE,LOW)		
76	3D		N16-0030-41	SPRING WASHER	(FOR BELT HOOK)	K	
77	2D		N35-3005-41	BINDING HEAD MACHINE SCREW		K	
78	3A		N19-0638-04	FLAT WASHER			
-			N09-2015-05	SCREW	(BATTERY CASE)	M1M2	
A	3A,3B		N09-2002-05	SCREW	(2X20)		
B	2A		N09-2008-05	SCREW	(2.6X8)		
C	3A,3B		N09-2009-05	SCREW	(2X4.5)		
D	2B		N09-2010-05	SCREW	(2X6)		
F	2A		N09-2016-05	SCREW	(2X4)		
G	2B		N35-2005-41	BINDING HEAD MACHINE SCREW			
H	1A,1B		N35-2608-41	BINDING HEAD MACHINE SCREW			
K	2A		N87-2605-46	BRAZIER HEAD TAPTITE SCREW			
VR3	1A		R05-4419-05	SQL VOL	(50KB)		
VR4	1A		R05-3440-05	AF VOL	(10KA)		
S3	1A		S40-1401-05	PUSH SWITCH	(SELF LOCK)	KM1M2X	
S3	1A		S40-1401-05	PUSH SWITCH	(SELF LOCK)	T	
S3	1A		S40-1402-05	PUSH SWITCH	(NON LOCK)	W	
S4	1A		S40-1401-05	PUSH SWITCH	(SELF LOCK)		
92	3D	⁎	T90-0352-05	ANTENNA			
95	2C		W09-0315-15	BATTERY CHARGER(120V)		K	
95	1C		W09-0317-15	BATTERY CHARGER(220V)		W	
95	1C		W09-0318-15	BATTERY CHARGER(240V)		T	
95	1C		W09-0319-15	BATTERY CHARGER(240V)		X	
103	2D		W09-0361-05	BATTERY PACK		KTW	
103	2D		W09-0361-05	BATTERY PACK		X	
B1	1B		W09-0326-05	LITHIUM BATTERY			
106	2B		X44-3000-10	RF PC BOARD ASSY			
107	2A		X48-3020-10	IF PC BOARD ASSY		KM1M2	
107	2A		X48-3020-10	IF PC BOARD ASSY		X	
107	2A		X48-3020-51	IF PC BOARD ASSY		TW	
CASE ASS'Y (A02-076X-05)							
200	2B	⁎	A02-0767-08	CASE		KM1M2X	
200	2B	⁎	A02-0769-08	CASE		TW	
201	1B	⁎	A33-0407-08	REFLECTOR			
202	1B	⁎	B10-0693-08	FRONT GLASS			
-		⁎	B03-0542-08	DRESSING PLATE			
-			B30-0849-05	LAMP	(3V,60MA)		
203	1B	⁎	E29-0476-08	LCD CONNECTOR	(15P)		
204	2B		G01-0837-05	COMPRESSION SPRING			
205	2B		J31-0526-04	MIC SPACER			

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206	2B		K29-3054-05	KNOB (PTT)		
207	2B		K29-3055-05	KNOB (MONITOR)		
209	1B		T07-0244-08	SPEAKER		
210	1B		T91-0312-15	MICROPHONE		
211		*	FTD8391	LCD		
D1			02CZ8.2	CHIP ZENER DIODE		
D2			DA204K	CHIP DIODE		
IC1			75106G-514-1B	MPU		
IC2			UPD7225G	LCD DRIVER		
Q1			2SC2412K	CHIP TRANSISTOR		
Q2			2SB1182	TRANSISTOR		
R10 ,18		*	KRR-C001	HIC		
RF UNIT (X44-3000-10)						
C1 ,2			CK73FB1H103K	CHIP C 0.010UF K		
C3 ,4			CK73FB1H102K	CHIP C 1000PF K		
C5 -7			CK73FB1H103K	CHIP C 0.010UF K		
C8			CC73FCH1H070D	CHIP C 7.0PF D		
C9			CC73FCH1H220J	CHIP C 22PF J		
C10 -12			CK73FB1H103K	CHIP C 0.010UF K		
C13			CC73FCH1H150J	CHIP C 15PF J		
C14			CC73FCH1H060D	CHIP C 6.0PF D		
C15 -19			CK73FB1H103K	CHIP C 0.010UF K		
C20			C90-2039-05	ELECTRO 15UF 16WV		
C21			C90-2048-05	ELECTRO 6.8UF 6.3WV		
C22			C90-2039-05	ELECTRO 15UF 16WV		
C23			CK73EB1E104K	CHIP C 0.10UF K		
C24			C90-2053-05	ELECTRO 47UF 6.3WV		
C25			C90-0478-05	ELECTRO 10UF 16WV		
C26 -29			CK73FB1H103K	CHIP C 0.010UF K		
C30			C90-0484-05	ELECTRO 0.47UF 50WV		
C31 ,32			CK73FB1H103K	CHIP C 0.010UF K		
C33			CC73FCH1H390J	CHIP C 39PF J		
C34 ,35			CC73FCH1H010C	CHIP C 1.0PF C		
C36			CK73FB1H102K	CHIP C 1000PF K		
C37 ,38			CC73FCH1H010C	CHIP C 1.0PF C		
C39			CC73FCH1H390J	CHIP C 39PF J		
C40 ,41			CK73FB1H103K	CHIP C 0.010UF K		
C43			C91-0769-05	CERAMIC 0.01UF M		
C44			CC73FCH1H270J	CHIP C 27PF J		
C45 ,46			CC73FCH1H040C	CHIP C 4.0PF C		
C47			CC73FCH1H070D	CHIP C 7.0PF D		
C48			CC73FCH1H101J	CHIP C 100PF J		
C49 ,50			CK73FB1H102K	CHIP C 1000PF K		
C51			CC73FCH1H070D	CHIP C 7.0PF D		
C52			CC73FCH1H020C	CHIP C 2.0PF C		
C53			CK73FB1H103K	CHIP C 0.010UF K		
C54			CC73FCH1H0R5C	CHIP C 0.5PF C		
C55			CC73FCH1H070D	CHIP C 7.0PF D		
C56			CC73FCH1H030C	CHIP C 3.0PF C		
C57			CK73FB1H103K	CHIP C 0.010UF K		
C58			CC73FCH1H0R5C	CHIP C 0.5PF C		
C59			CC73FCH1H070D	CHIP C 7.0PF D		
C60 ,61			CK73FB1H103K	CHIP C 0.010UF K		

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C62			CC73FCH1H180J	CHIP C 18PF J		
C63 -65			CK73FB1H103K	CHIP C 0.010UF K		
C66			CC73FCH1H080D	CHIP C 8.0PF D		
C67			CC73FCH1H330J	CHIP C 33PF J		
C68 ,69			CK73FB1H103K	CHIP C 0.010UF K		
C70			CC73FCH1H070D	CHIP C 7.0PF D		
C71			CC73FCH1H180J	CHIP C 18PF J		
C72			C90-2053-05	ELECTRO 47UF 6.3WV		
C73			CK73FB1H103K	CHIP C 0.010UF K		
C74			CC73FCH1H560J	CHIP C 56PF J		
C75			CC73FCH1H150J	CHIP C 15PF J		
C76			CK73FB1H103K	CHIP C 0.010UF K		
C77			C90-0478-05	ELECTRO 10UF 16WV		
C78			CK73FB1H102K	CHIP C 1000PF K		
C79			CK73FB1E223K	CHIP C 0.022UF K		
C80			CK73FB1H182K	CHIP C 1800PF K		
C81			CC73FCH1H101J	CHIP C 100PF J		
C82			CC73FSL1H471J	CHIP C 470PF J		
C83			CK73FB1H103K	CHIP C 0.010UF K		
C84			CS15E1C010M	TANTAL 1.0UF 16WV		
C85			CS15E1VR47M	TANTAL 0.47UF 35WV		
C86 ,87			CK73FB1H103K	CHIP C 0.010UF K		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73EB1E104K	CHIP C 0.10UF K		
C90			C90-1408-05	ELECTRO 220UF 6.3WV		
TC1			C05-0326-05	CERAMIC TRIMMER(10P)		
-		*	E29-0472-04	TERMINAL (GND)		
CN1		*	E40-5090-05	PIN CONNECTOR		
CN2		*	E40-3237-05	MINI CONNECTOR (2P)		
TP1 ,2			E23-0443-05	TERMINAL (TEST)		
-		*	F02-0427-14	HEAT SINK(CAP/ADDITION TYPE)		
-		*	F11-1038-14	SHIELDING COVER		
-		*	J30-0545-05	SPACER (FOR MCF)		
-			J31-0503-05	BEAD		
-			J39-0425-14	SPACER		
L1		*	L40-1581-80	SMALL FIXED INDUCTOR(CHIP,150N		
L2		*	L40-3372-80	SMALL FIXED INDUCTOR(CHIP,33N)		
L3		*	L40-8272-80	SMALL FIXED INDUCTOR(CHIP,82N)		
L4		*	L40-5672-80	SMALL FIXED INDUCTOR(CHIP,56N)		
L5 -7			L33-0680-05	CHOKE COIL		
L8		*	L79-0700-05	FILTER MODULE (LP163A2)		
L9			L40-1092-14	SMALL FIXED INDUCTOR(1UH)		
L10 ,11			L34-0892-05	COIL		
L12			L34-0894-05	COIL		
L13		*	L34-3159-05	COIL		
L14		*	L34-4016-05	COIL (RF)		
L15 -17			L34-2216-05	COIL (RF)		
L18			L40-1001-14	SMALL FIXED INDUCTOR(10UH)		
L19		*	L34-4017-05	COIL (1ST IF)		
L20		*	L40-2281-80	SMALL FIXED INDUCTOR(CHIP,220N		
L21		*	L40-8272-80	SMALL FIXED INDUCTOR(CHIP,82N)		
L22			L33-0680-05	CHOKE COIL		
L23			L92-0110-05	BEAD CORE		

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L24 ,25			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L26			L40-1092-14	SMALL FIXED INDUCTOR(1UH)		
X1		*	L77-1325-05	CRYSTAL RESONATOR (12.8MHZ)		
XF1 ,2		*	L71-0265-05	MCF (16.3MHZ)		
-			N09-2017-05	TAPTYTE SCREW (Ø1.7X2.8)		
JP1			R92-0150-05	JUMPER REST 0 OHM		
R1			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R2			RK73FB2A153J	CHIP R 15K J 1/10W		
R3			RK73FB2A471J	CHIP R 470 J 1/10W		
R4			RK73FB2A821J	CHIP R 820 J 1/10W		
R5			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A101J	CHIP R 100 J 1/10W		
R8			RK73FB2A331J	CHIP R 330 J 1/10W		
R9			RK73FB2A560J	CHIP R 56 J 1/10W		
R10			RK73FB2A470J	CHIP R 47 J 1/10W		
R11			RK73FB2A220J	CHIP R 22 J 1/10W		
R12			RK73FB2A103J	CHIP R 10K J 1/10W		
R13			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R14			RK73FB2A681J	CHIP R 680 J 1/10W		
R15			RK73FB2A120J	CHIP R 12 J 1/10W		
R16 ,17			RK73FB2A331J	CHIP R 330 J 1/10W		
R18			RK73FB2A221J	CHIP R 220 J 1/10W		
R19			RK73FB2A682J	CHIP R 6.8K J 1/10W		
R20			RK73FB2A333J	CHIP R 33K J 1/10W		
R21			RK73FB2A103J	CHIP R 10K J 1/10W		
R22			RK73FB2A221J	CHIP R 220 J 1/10W		
R23 ,24			RK73FB2A820J	CHIP R 82 J 1/10W		
R25			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R29			RK73FB2A104J	CHIP R 100K J 1/10W		
R30			RD14BB2C103J	RD 10K J 1/6W		
R31			RK73FB2A271J	CHIP R 270 J 1/10W		
R32 ,33			RK73FB2A103J	CHIP R 10K J 1/10W		
R34			RK73FB2A104J	CHIP R 100K J 1/10W		
R35			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R36			RD14BB2C470J	RD 47 J 1/6W		
R37 -39			RK73FB2A104J	CHIP R 100K J 1/10W		
R40			RK73FB2A470J	CHIP R 47 J 1/10W		
R41			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R42			RK73FB2A470J	CHIP R 47 J 1/10W		
R43			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R44			RK73FB2A103J	CHIP R 10K J 1/10W		
R45			RD14BB2C471J	RD 470 J 1/6W		
R46			RD14BB2C470J	RD 47 J 1/6W		
R47			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R48			RD14BB2C101J	RD 100 J 1/6W		
R49			RD14BB2C334J	RD 330K J 1/6W		
R50			RK73FB2A271J	CHIP R 270 J 1/10W		
R51			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R52			RK73FB2A223J	CHIP R 22K J 1/10W		
R53			RK73FB2A104J	CHIP R 100K J 1/10W		
R54			RK73FB2A223J	CHIP R 22K J 1/10W		
R55 -57			RK73FB2A104J	CHIP R 100K J 1/10W		

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R58 ,59			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R60			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R61			RK73FB2A103J	CHIP R 10K J 1/10W		
R62			RK73FB2A183J	CHIP R 18K J 1/10W		
R63			RK73FB2A394J	CHIP R 390K J 1/10W		
R64			RK73FB2A104J	CHIP R 100K J 1/10W		
R65			RK73FB2A473J	CHIP R 47K J 1/10W		
R66			RD14BB2C823J	RD 82K J 1/6W		
D1		⁎	HSM2693	CHIP DIODE		
D2			DA204K	CHIP DIODE		
D3		⁎	1SV172	CHIP DIODE		
D4			DA204K	CHIP DIODE		
D5			MI303	DIODE		
D6			MI301	DIODE		
D7		⁎	1SS277	DIODE		
D8 ,9			HSM88AS	VARICAP DIODE		
D10 -13			1SV153	DIODE		
D14			ERB83-004	DIODE		
D15		⁎	UZP-22B	ZENER DIODE		
D16			ERB83-004	DIODE		
IC1		⁎	M57732L	IC(POWER MODULE/ 135-160MHZ,5W		
IC2		⁎	M54959P	IC(FREQ SYNTHESIZER PLL)		
Q1			2SC2714(O)	CHIP TRANSISTOR		
Q2			2SC3838K(N,P)	CHIP TRANSISTOR		
Q3			2SC2407	TRANSISTOR		
Q4			2SA1313(Y)	CHIP TRANSISTOR		
Q5			FMW1	DIGITAL TRANSISTOR		
Q6			2SC3356	CHIP TRANSISTOR		
Q7			2SC2714(O)	CHIP TRANSISTOR		
Q8			2SK210(GR)	CHIP FET		
Q9			2SC2714(O)	CHIP TRANSISTOR		
Q10			2SC3838K(N,P)	CHIP		
Q11		⁎	FMG4	DIGITAL TRANSISTOR		
Q12 ,13			2SC2712(GR)	TRANSISTOR		
Q14		⁎	FMG4	DIGITAL TRANSISTOR		
131	2B		X58-3010-10	SUB UNIT (VCO)		
IF UNIT (X48-3020-XX) -10 : TH-215A, -51 : TH-215E						
C1			CE04CW1H010M	ELECTRO 1.0UF 50WV		
C2			CK73FB1H471K	CHIP C 470PF K		
C3 ,4			CK73FB1H102K	CHIP C 1000PF K		
C5 ,6			C90-0890-05	CHIP TAN 1UF 16WV		
C7			C91-0769-05	CERAMIC 0.01UF M		
C8			CK73FB1H103K	CHIP C 0.010UF K		
C9			C90-0888-05	CHIP TAN 0.1UF 16WV		
C10			CK73FB1H102K	CHIP C 1000PF K		
C11			CC73FCH1H390J	CHIP C 39PF J		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			CK73FB1H123K	CHIP C 0.012UF K		
C14			CK73FB1H122K	CHIP C 1200PF K		
C15			CK73FB1H102K	CHIP C 1000PF K		
C16			CK73FB1H123K	CHIP C 0.012UF K		
C17			CK73FB1H103K	CHIP C 0.010UF K		
C19			CK73FB1E223K	CHIP C 0.022UF K		

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C20			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H820J	CHIP C 82PF J		
C24			CC73FCH1H330J	CHIP C 33PF J		
C25 -27			CK73EB1E104K	CHIP C 0.10UF K		
C28			C90-2050-05	ELECTRO 33UF 6.3WV		
C29			CK73EB1E104K	CHIP C 0.10UF K		
C30			C90-1248-05	ELECTRO 1UF 50WV		
C31			C90-0890-05	CHIP TAN 1UF 16WV		
C32			CK73FB1H102K	CHIP C 1000PF K		
C33			CK73FB1H222K	CHIP C 2200PF K		
C34			CK73FB1H102K	CHIP C 1000PF K		
C35			CK73FB1H681K	CHIP C 680PF K		
C36			CE04CW1A470M	ELECTRO 47UF 10WV		
C37 ,38			C90-2012-05	ELECTRO 100UF 10WV		
C39			C91-1015-05	FILM 0.18UF		
C40 ,41			C90-0885-05	TANTAL 10UF 6.3WV		
C42			CK73FB1H103K	CHIP C 0.010UF K		
C43			CE04CW1A330M	ELECTRO 33UF 10WV		
C44			C90-1248-05	ELECTRO 1UF 50WV		
C45			CK73FB1H102K	CHIP C 1000PF K		
C46			C90-1248-05	ELECTRO 1UF 50WV		
C47			CE04CW1C220M	ELECTRO 22UF 16WV		
C48			CE04CW1C470M	ELECTRO 47UF 16WV		
C49			CK73FF1E104Z	CHIP C 0.10UF Z		
C50			CK73FB1H471K	CHIP C 470PF K		
C51			CE04CW1C4R7M	ELECTRO 4.7UF 16WV		
C52			CK73FB1H152K	CHIP C 1500PF K		
C53			CK73FB1H103K	CHIP C 0.010UF K		
C54			C90-0891-05	TANTAL 4.7UF 16WV		
C56 ,57			CK73FB1H103K	CHIP C 0.010UF K		
C58			CE04CW1HR22M	ELECTRO 0.22UF 50WV		
C59			CK73FB1H102K	CHIP C 1000PF K		
C60			C90-0868-05	ELECTRO 10UF 16WV		
C61 ,62			CK73FB1H471K	CHIP C 470PF K		
C63			C90-0868-05	ELECTRO 10UF 16WV		
C64			CK73FB1H102K	CHIP C 1000PF K	KM1M2X	
C65			CK73FB1H471K	CHIP C 470PF K	KM1M2X	
C68			C90-2011-05	ELECTRO 4.7UF 25WV		
C69			C90-1248-05	ELECTRO 1UF 50WV		
C70			CK73FB1H471K	CHIP C 470PF K		
C70			CK73FB1H471K	CHIP C 470PF K		
C71			CE04CW0J220M	ELECTRO 22UF 6.3WV		
C72 -74			CK73FB1H471K	CHIP C 470PF K		
C75			C90-1248-05	ELECTRO 1UF 50WV		
C76			C90-2048-05	ELECTRO 6.8UF 6.3WV		
C77 ,78			CK73FB1H102K	CHIP C 1000PF K		
C83			CE04CW1C470M	ELECTRO 47UF 16WV		
C84			CK73FB1H471K	CHIP C 470PF K		
C85			C90-2049-05	ELECTRO 15UF 6.3WV		
C86			CK73FB1H471K	CHIP C 470PF K		
C87			C90-2048-05	ELECTRO 6.8UF 6.3WV		
C88			CK73FB1H102K	CHIP C 1000PF K		
C89			CK73FB1H471K	CHIP C 470PF K		
C90			CK73FB1H102K	CHIP C 1000PF K		
C91			CK73FB1H471K	CHIP C 470PF K		

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C92			C90-2073-05	ELECTRO CAPACITOR(AL)		
C93 -96			CK73FB1H102K	CHIP C 1000PF K		
C97			CK73FB1H471K	CHIP C 470PF K		
C98			C90-2049-05	ELECTRO 15UF 6.3WV		
C99			CK73FB1H102K	CHIP C 1000PF K		
C100			CK73FB1H471K	CHIP C 470PF K		
C101			CK73FB1H102K	CHIP C 1000PF K		
C102			CE04CW1C220M	ELECTRO 22UF 16WV		
C103			CK73FB1H471K	CHIP C 470PF K		
CN2			E40-5039-05	PIN CONNECTOR (5597-15CPB)		
CN3			E40-5021-05	PIN CONNECTOR (7P)	KM1M2X	
CN4			E40-5034-05	PIN CONNECTOR (5597-10CPB)		
CF1			L72-0335-05	CERAMIC FILTER (CFU455E2)		
L2 ,3			L30-0538-05	IFT (455KHZ)		
L4			L40-4791-14	SMALL FIXED INDUCTOR(4.7KHZ)		
X1			L77-1323-05	CRYSTAL RESONATOR(16.722MHZ)		
Q13			2SA1313(Y)	CHIP TRANSISTOR		
-			R92-0150-05	JUMPER REST 0 OHM	KM1MX	
CJ1 ,2			R92-0670-05	CHIP R 0 OHM		
CJ3			R92-0670-05	CHIP R 0 OHM	TW	
JP1 ,2			R92-1061-05	JUMPER REST 0 OHM		
JP3			R92-1061-05	JUMPER REST 0 OHM	TW	
R1			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R2			RK73FB2A271J	CHIP R 270 J 1/10W		
R3			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R4			RK73FB2A271J	CHIP R 270 J 1/10W		
R6			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R7			RK73FB2A564J	CHIP R 560K J 1/10W		
R9			RK73FB2A153J	CHIP R 15K J 1/10W		
R10			RK73FB2A333J	CHIP R 33K J 1/10W		
R11			RK73FB2A223J	CHIP R 22K J 1/10W		
R12			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R14			RK73FB2A103J	CHIP R 10K J 1/10W		
R15 ,16			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R17			RK73FB2A823J	CHIP R 82K J 1/10W		
R18			RK73FB2A333J	CHIP R 33K J 1/10W		
R19			RK73FB2A223J	CHIP R 22K J 1/10W		
R20			RK73FB2A103J	CHIP R 10K J 1/10W		
R21			RK73FB2A473J	CHIP R 47K J 1/10W		
R23			RK73FB2A103J	CHIP R 10K J 1/10W		
R24			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R25			RK73FB2A473J	CHIP R 47K J 1/10W		
R26			RD14CB2C123J	RD 12K J 1/6W		
R28			RK73FB2A471J	CHIP R 470 J 1/10W		
R29 ,30			RK73FB2A103J	CHIP R 10K J 1/10W		
R31			RK73FB2A333J	CHIP R 33K J 1/10W		
R32			RD14BB2C822J	RD 8.2K J 1/6W		
R33			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R34			RK73FB2A333J	CHIP R 33K J 1/10W		
R35			RK73FB2A103J	CHIP R 10K J 1/10W		
R36			RK73FB2A473J	CHIP R 47K J 1/10W		
R37			RK73FB2A100J	CHIP R 10 J 1/10W		
R38			RD14BB2C272J	RD 2.7K J 1/6W		

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R39			RK73FB2A273J	CHIP R 27K J 1/10W		
R40			RK73FB2A223J	CHIP R 22K J 1/10W		
R41			RK73FB2A103J	CHIP R 10K J 1/10W		
R42			RK73FB2A151J	CHIP R 150 J 1/10W		
R43			RK73FB2A224J	CHIP R 220K J 1/10W	KM1M2X	
R44			RK73FB2A474J	CHIP R 470K J 1/10W	KM1M2X	
R45			RD14BB2C472J	RD 4.7K J 1/6W		
R46			RK73FB2A473J	CHIP R 47K J 1/10W		
R47			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R48			RD14BB2C272J	RD 2.7K J 1/6W		
R49			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R51			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R52			RK73FB2A124J	CHIP R 120K J 1/10W		
R53			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R54			RK73FB2A473J	CHIP R 47K J 1/10W		
R55			RK73FB2A223J	CHIP R 22K J 1/10W		
R56			RK73FB2A473J	CHIP R 47K J 1/10W		
R57			RK73FB2A223J	CHIP R 22K J 1/10W		
R58			RK73FB2A822J	CHIP R 8.2K J 1/10W		
VR1			R12-3447-05	TRIMMING POT. (10K)		
VR2			R12-1431-05	TRIMMING POT. (1K)		
VR5			R12-6406-05	TRIMMING POT. (470K)		
VR6			R12-1437-05	TRIMMING POT. (3.3K)		
VR7		*	R12-1436-05	TRIMMING POT. (1K)		
VR8			R12-5422-05	TRIMMING POT. (100K)	KM1M2X	
S1 ,2	2B		S40-1412-05	TACT SWITCH (EVQ-QSH03B)		
D1			HSM88AS	CHIP DIODE		
D3			1SS184	CHIP DIODE		
D4 ,5			02CZ8.2	CHIP ZENER DIODE		
D6			1SS184	CHIP DIODE		
D7			1SS226	CHIP DIODE		
IC1			TA7761P	IC(FM IF)		
IC2			BA526	IC(AF POWER AMP/ 700MW)		
IC3			S-8054HN	IC(VOLTAGE DETECTOR)		
IC4 ,5			LVC550C	IC(VOLTAGE REGULATOR/ +5V)		
Q1 ,2			2SC2712(GR)	CHIP TRANSISTOR		
Q3			DTC144EK	DIGITAL TRANSISTOR		
Q4			2SC2712(GR)	CHIP TRANSISTOR		
Q5			2SJ106(GR)	CHIP FET		
Q6			FMG2	DIGITAL TRANSISTOR		
Q7			2SC2712(GR)	CHIP TRANSISTOR		
Q8			2SA1241(Y)	TRANSISTOR		
Q9			DTC143XK	DIGITAL TRANSISTOR		
Q10			FMG2	DIGITAL TRANSISTOR	KM1M2X	
Q11			DTA114YK	DIGITAL TRANSISTOR(10K,47K)		
Q12			DTA144EK	DIGITAL TRANSISTOR(47K,47K)		
Q14			2SA1358(Y)	TRANSISTOR		
Q15			FMW1	DIGITAL TRANSISTOR		
Q16 -18			DTC114YK	DIGITAL TRANSISTOR(47K,47K)		
Q19			FMG2	DIGITAL TRANSISTOR		
Q20			DTC144EK	DIGITAL TRANSISTOR	KM1M2X	
TH1			PTH59T103M	POSISTOR		
TH2			112-202-2	THERMISTOR		
TH3			112-101-2	THERMISTOR		

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B1	1B	⁎	W09-0371-05	LITHIUM BATTERY (CR2032-T12)		
-			X59-3090-10	MODULE UNIT (MIC AMP)		
			VCO (X58-3010-10)			
C1			CC73FCH1H030C	CHIP C 3.0PF C		
C2			CK73FF1E104Z	CHIP C 0.10UF Z		
C3			CC73FRH1H680J	CHIP C 68PF J		
C4			CC73FCH1H060D	CHIP C 6.0PF D		
C5			CK73EB1E104K	CHIP C 0.10UF K		
C6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CC73FCH1H030C	CHIP C 3.0PF C		
C8			CK73FB1H102K	CHIP C 1000PF K		
C9			CC73FRH1H680J	CHIP C 68PF J		
C10			CC73FCH1H060D	CHIP C 6.0PF D		
C11			CC73FCH1H030C	CHIP C 3.0PF C		
C12			CK73FB1H102K	CHIP C 1000PF K		
TC1 ,2			C05-0329-05	TRIMMING CAP (6P)		
-			E23-0465-05	TEST PIN		
-		⁎	E40-5092-05	TERMINAL		
-			F11-1039-04	SHIELDING CASE		
L1		⁎	L34-4013-05	COIL		
L2			L40-1892-81	SMALL FIXED INDUCTOR(1.8UH)		
L3		⁎	L34-4014-05	COIL		
L4			L40-1892-81	SMALL FIXED INDUCTOR(1.8UH)		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R2			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R3			RK73FB2A104J	CHIP R 100K J 1/10W		
R4			RK73FB2A151J	CHIP R 150 J 1/10W		
R5 ,6			RK73FB2A103J	CHIP R 10K J 1/10W		
R7			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R8			RK73FB2A104J	CHIP R 100K J 1/10W		
R9			RK73FB2A181J	CHIP R 180 J 1/10W		
D1			1SV153	VARI CAP		
D2			1SS277	DIODE		
D3 ,4			1SV153	VARI CAP		
D5			1SS277	DIODE		
D6 ,7			1SV153	VARI CAP		
Q1 ,2			2SK302(GR)	CHIP FET		
			MIC AMP (X59-3090-10)			
C1			CK73FB1E223K	CHIP C 0.022UF K		
C2			CK73FB1H471K	CHIP C 470PF K		
C3			C92-0005-05	CHIP TAN 2.2UF 6.3WV		
C4			CK73FB1H182K	CHIP C 1800PF K		
C5			CC73FCH1H151J	CHIP C 150PF J		
C6			CK73FB1H103K	CHIP C 0.010UF K		
C7			CK73FB1H471K	CHIP C 470PF K		
-			E23-0471-05	TERMINAL		
R1			RK73FB2A104J	CHIP R 100K J 1/10W		
R2			RK73FB2A103J	CHIP R 10K J 1/10W		
R3 ,4			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R5			RK73FB2A391J	CHIP R 390 J 1/10W		

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R6			RK73FB2A823J	CHIP R　82K　J　1/10W		
R7 ,8			RK73FB2A104J	CHIP R　100K　J　1/10W		
R9			RK73FB2A472J	CHIP R　4.7K　J　1/10W		
IC1		*	NJM4560M	IC(OP AMP X2)		

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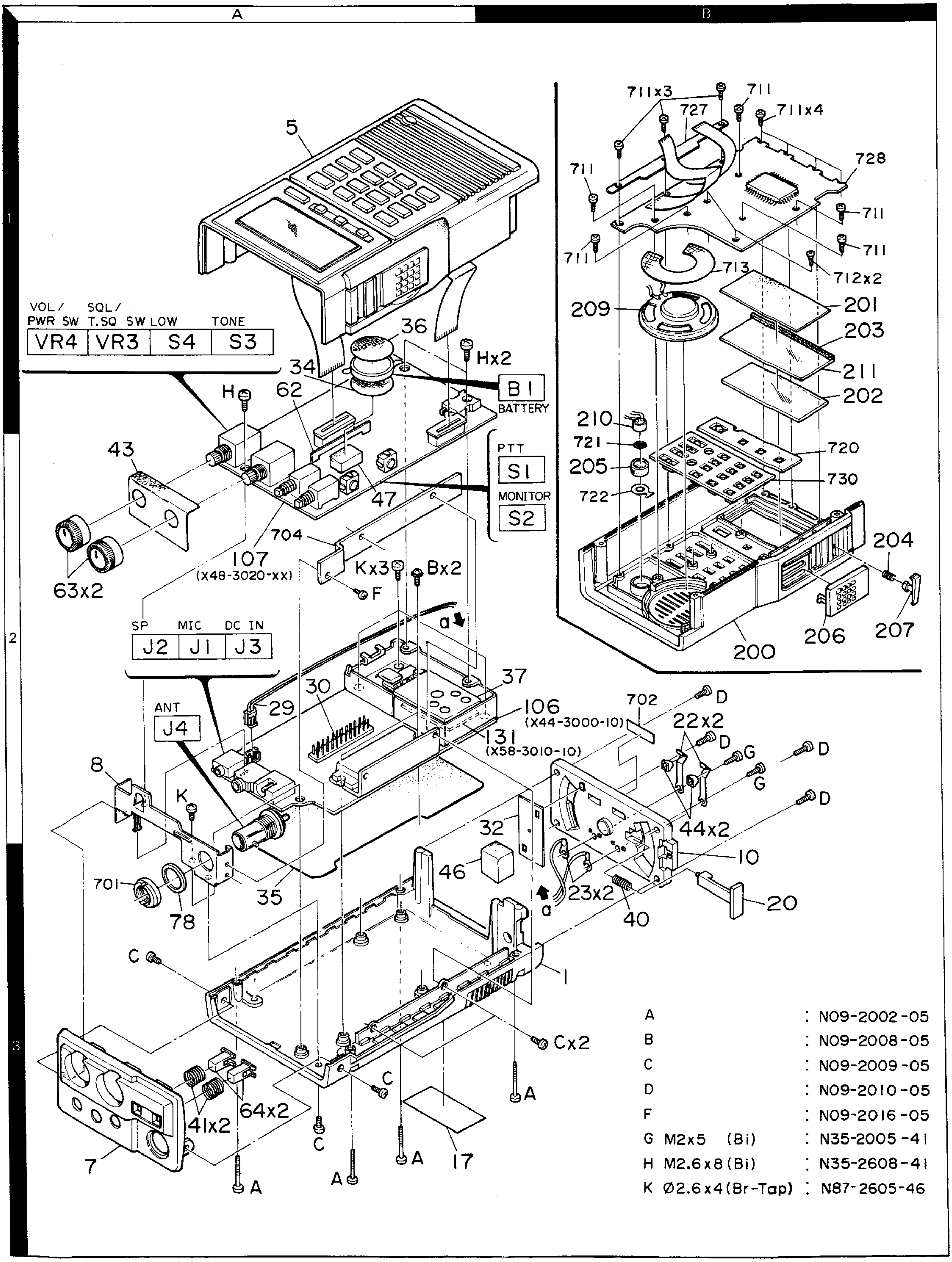
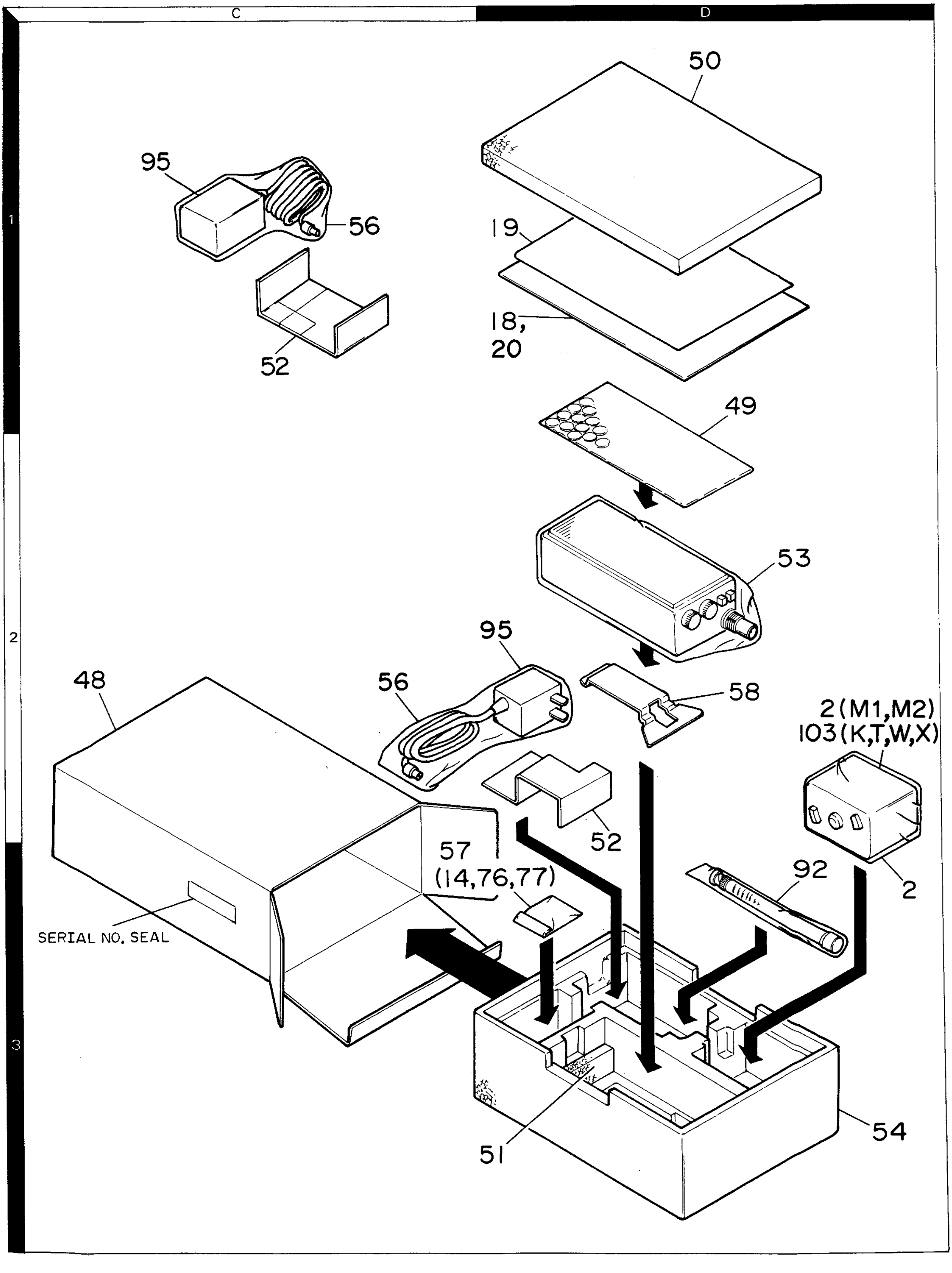
EXPLODED VIEW

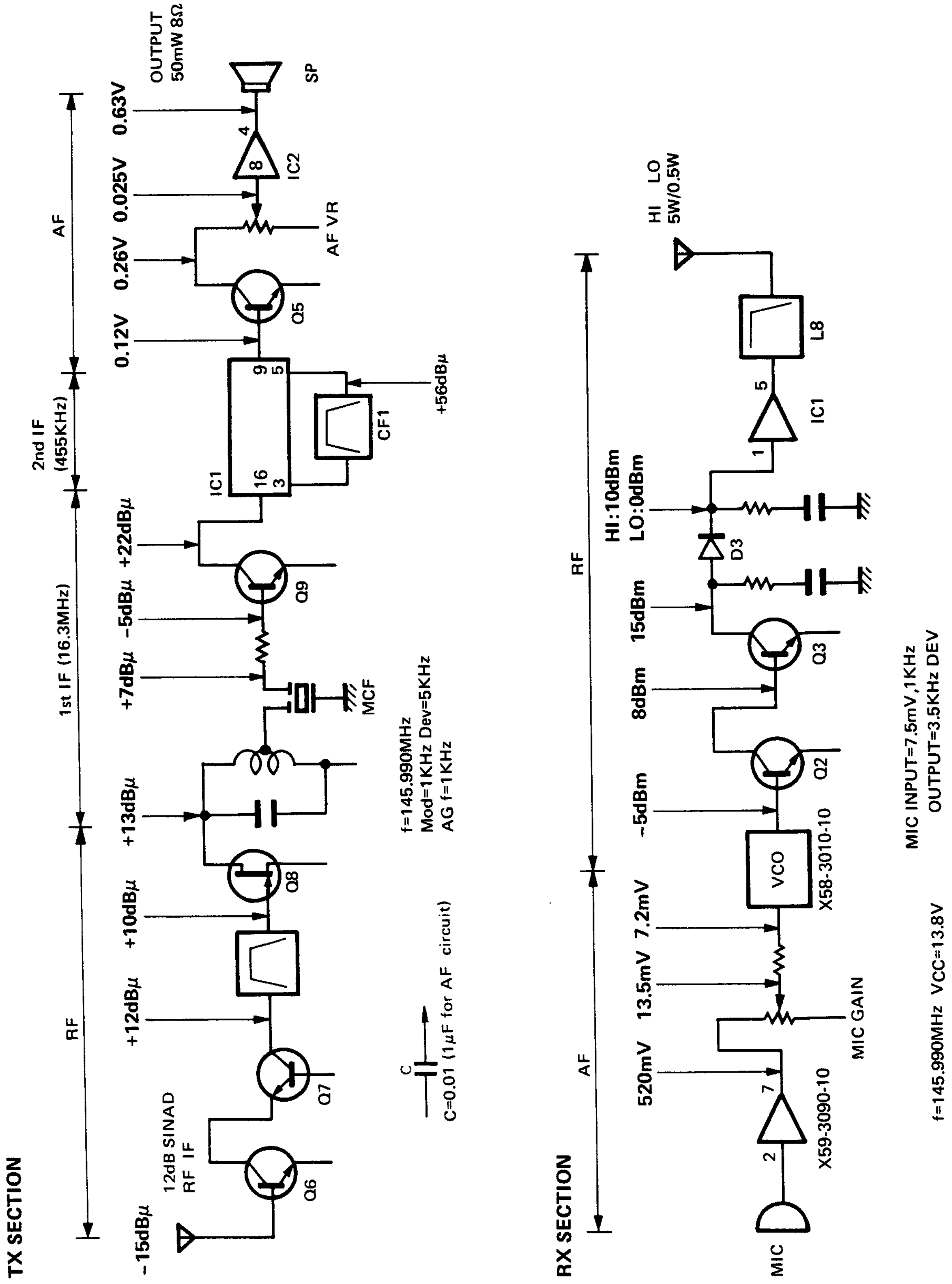

A
B
1
2
3
5
VOL / PWR SW
SQL / T.SQ
SW LOW
TONE
VR4
VR3
S4
S3
36
Hx2
34
62
H
B1
BATTERY
43
47
PTT
S1
MONITOR
S2
704
107
(X48-3020-XX)
Kx3
Bx2
63x2
F
SP
MIC
DC IN
J2
J1
J3
a
29
30
37
ANT
J4
106
(X44-3000-10)
131
(X58-3010-10)
702
D
22x2
G
8
K
32
44x2
10
46
701
78
35
23x2
40
20
a
C
1
Cx2
C
A
41x2
64x2
7
C
A
A
17
A
711x3
711
727
711x4
728
711
711
711
711
713
712x2
209
201
203
211
202
210
721
205
722
720
730
204
206
207
200

A		: N09-2002-05
B		: N09-2008-05
C		: N09-2009-05
D		: N09-2010-05
F		: N09-2016-05
G	M2x5 (Bi)	: N35-2005-41
H	M2.6x8(Bi)	: N35-2608-41
K	Ø2.6x4(Br-Tap)	: N87-2605-46

PACKING


C
D
1
2
3
50
95
56
19
18,
20
52
49
53
95
56
48
58
2(M1,M2)
103(K,T,W,X)
52
57
(14,76,77)
92
2
SERIAL NO. SEAL
54
51

LEVEL DIAGRAM


TX SECTION
RF
1st IF (16.3MHz)
2nd IF (455KHz)
AF
−15dBμ
12dB SINAD
RF IF
+12dBμ
+10dBμ
+13dBμ
+7dBμ
−5dBμ
+22dBμ
0.12V
0.26V
0.025V
0.63V
OUTPUT
50mW 8Ω
SP
Q6
Q7
Q8
MCF
Q9
IC1
16
3
9
5
CF1
+56dBμ
Q5
AF VR
8
IC2
4
C
C=0.01 (1μF for AF circuit)
f=145.990MHz
Mod=1KHz Dev=5KHz
AG f=1KHz
RX SECTION
AF
RF
MIC
2
7
X59-3090-10
MIC GAIN
520mV
13.5mV
7.2mV
VCO
X58-3010-10
−5dBm
Q2
8dBm
Q3
15dBm
D3
HI:10dBm
LO:0dBm
1
IC1
5
L8
HI LO
5W/0.5W
MIC INPUT=7.5mV,1KHz
OUTPUT=3.5KHz DEV
f=145.990MHz VCC=13.8V

ADJUSTMENT

REQUIRED TEST EQUIPMENT

1. Stabilized Power Supply

1) The supply voltage can be changed between 5V and 18V, and the current is 3A or more.

2) The standard voltage is 13.8V.

2. DC Ammeter

1) Class 1 ammeter (17 ranges and other features)

2) The full scale can be set to either 300mA or 10A.

3) A cable of less internal loss must be used.

3. Frequency Counter (f. counter)

1) Frequencies of up to 1GHz or so can be measured.

2) The sensitivity can be changed to 250MHz or below, and measurements are highly stable and accurate (0.2 ppm or so).

4. Power Meter

1) Measurable frequency : Up to 500MHz

2) Impedance : 50Ω, unbalanced

3) Measuring range : Full scal of 10W or so

4) A standard cable (5D2W 1m) must be used.

5. RF VTVM (RF V.M)

1) Measurable frequency : Up to 500MHz or so

6. Linear Detector

1) Measurable frequency : Up to 500MHz

2) Characteristics are flat, and CN is 60dB or more.

7. Digital Voltmeter

1) Voltage range : FS = 18V or so

2) Input resistance : 1MΩ or more

8. Oscilloscope

1) Measuring range : DC to 30MHz

2) Provides highly accurate measurments for 5 to 25 MHz.

9. AF Voltmeter (AF VTVM)

1) Measurable frequency : 50Hz to 1MHz

2) Maximum sensitivity : 1mV or more

10. Spectrum Analyzer

1) Measuring range : DC to 1GHz or more

11. Standard Signal Generator (SSG)

1) Maximum frequency : 500MHz or more

2) Output : –20dB/0.1μV to 120dB/1V

3) Output impedance : 50Ω

12. Tracking Generator

1) Center frequency : 50kHz to 200MHz

2) Frequency deviation : ±35MHz

3) Output voltage : 100mV or more

13. Dummy Load

1) 8Ω, 3W or more

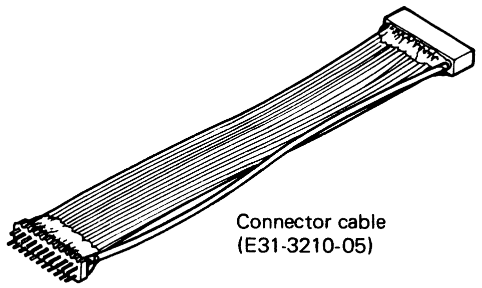
PREPARATION

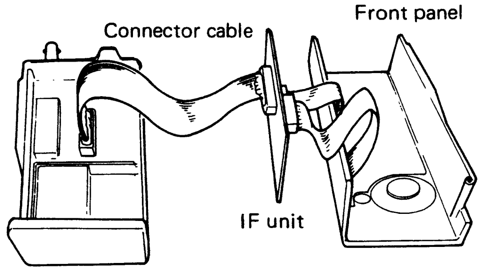
- Set the unit in the receiving mode and set the controls as follows, unless otherwise specified.

  POWER/VOL .... ON
  SQL VR .... MIN
  F.LOCK .... OFF
  HI/LOW .... HI

- Use a non-conductive rod such as a Bakelite rod for adjustment (especially of trimmers and coils).
- To protect the SSG, do not send out signals while adjusting the receiving unit.
- The indicated SSG output levels are for maximum output.

Measuring Jigs

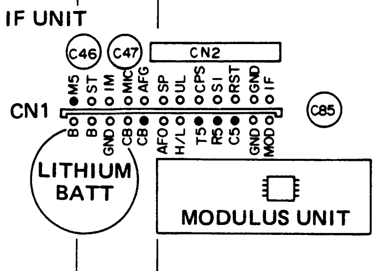




Be careful with the inserting direction when connecting the cables.

ADJUSTMENT

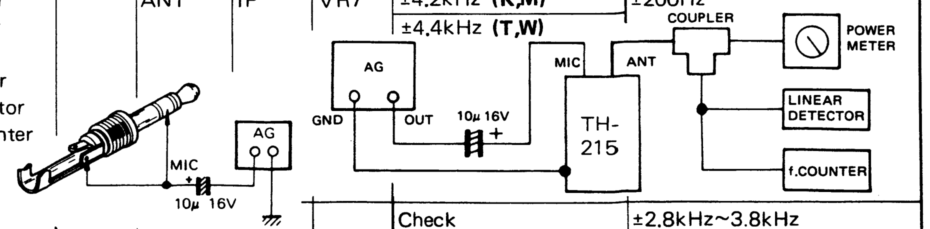
TX/RX COMMON ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Voltage check	1) Power supply voltage : 13.8V (DC IN terminal)	DC V.M	IF	CN1-5 (CB)	 IF UNIT C46 C47 CN2 CN1 M5 ST IM MIC AFG SP UL CPS SI RST GND IF BO BO GND CB CB AFO H/L T5 R5 C5 GND MOD C85 LITHIUM BATT MODULUS UNIT			13.1V
	2) C5			CN1-10 (C5)				5.0V
	3) R5			CN1-9 (R5)				4.9V
	4) M5			CN1-24 (M5)				5.0V
	5) T5 PTT : ON			CN1-8 (T5)				4.8V
	6) PTT : OFF							

PLL ADJUSTMENT

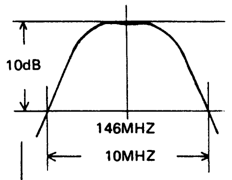
Item		Condition	Measurement			Adjustment			Specification/Remarks
			Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reference FREQ.		1) FREQ. : 145.00MHz PTT : ON	f.counter Power meter		ANT	RF	TC1	145.00MHz	±100Hz
2. VCV	RX	1) FREQ. : 145.99MHz	DC V.M	RF	TP2	RF (VCO PCB)	TC2	2.4V	±0.2V
		2) FREQ. : 144.00MHz						Check	2.0V or more.
	TX	3) FREQ. : 145.99MHz					TC1	2.2V	±0.2V
		4) FREQ. : 144.00MHz						Check	1.8V or more.

TX ADJUSTMENT

Item		Condition	Measurement			Adjustment			Specification/Remarks
			Test equipment	Unit	Terminal	Unit	Part	Method	
1. Power ADJ.	HI	1) FREQ. : 145.00MHz PTT : ON	Power meter	ANT terminal	ANT	IF	VR2	5.3W	5W or more.
	LOW	2) FREQ. : 145.00MHz PTT : ON					VR1	0.5W	0.3W~0.7W Power consumption : 0.7A or less.
2. DEV.		1) Connect a power meter, linear detector, and f.counter to the ANT terminal FREQ. : 144.90MHz AG output : 1kHz, 80mV PTT : ON	Power meter AG Linear detector f.counter		ANT	IF	VR7	±4.2kHz **(K,M)** ±4.4kHz **(T,W)**	±200Hz  MIC 10μ 16V AG AG GND OUT 10μ 16V MIC ANT TH-215 COUPLER POWER METER LINEAR DETECTOR f.COUNTER
		2) AG output : 1kHz, 8mV						Check	±2.8kHz~3.8kHz
3. TONE **(K,M type only)**		1) FREQ. : 144.90MHz TONE : ON PTT : ON	Power meter Linear detector f.counter			IF	VR8	±0.8kHz	±200Hz
3. TONE **(W type only)**		1) FREQ. : 144.90MHz TONE : ON PTT : ON				IF	VR6	±3kHz	±400Hz
3. TONE **(T type only)**		1) FREQ. : 144.90MHz PTT : ON						Check	TONE signal disappear with 0.4~0.8 sec.
4. DTMF **(K,M type only)**		1) FREQ. : 144.90MHz keyboard : SAVE 7 push PTT : ON	Power meter Linear detector f.counter			Case ass'y	VR6	DEV. ±3.0kHz	±400Hz
								Check	f : 1633±5Hz
		2) Keyboard : 0 push						Check	DEV. ±1.2kHz±0.5kHz

ADJUSTMENT

RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Method	
1. Reception sensitivity	1) Connect a tracking generator to the ANT terminal. Connect a spetrum analyzer to the TP1 terminal of the RF unit.	Tracking generator Spectrum analyzer	RF	ANT TP1	RF	L14	146MHz MAX.	
						L15~L17		The gain and band are MAX. A gain of −10dB is obtained over at least 146MHz±5MHz.
	2) Connect a SSG to the ANT FREQ. : 144.90MHz SSG output : 60dBμ MOD : 1kHz DEV. : ±3kHz	SSG AF VTVM Oscilloscope	ANT terminal SP terminal	SP	IF	L3	AF output : MAX	
	3) SSG output : −8dBμ	DC V.M	ANT	IC7	IF	L2	MIN.	
			SP	7P	RF	L19		
		Distortion meter Oscilloscope AF VTVM		SP			Check	SINAD 12dB or more.
2. S meter	1) FREQ. : 145.98MHz SSG output : −7dBμ	S meter			IF	VR5	Adjust VR5 to the "S−1" reading.	
	2) SSG output : −10dBμ						Check.	Lights OFF.
	3) SSG output : 23dBμ						Check.	All segments light ON.

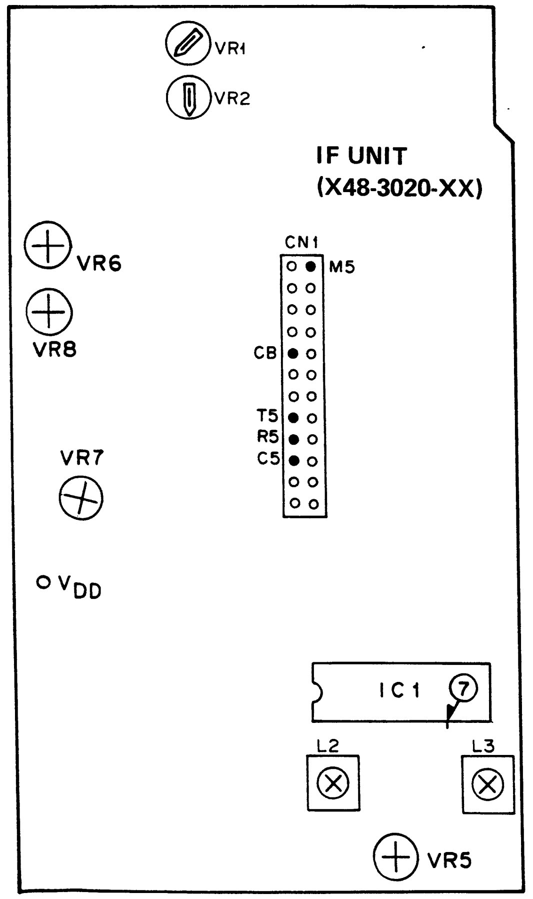
Microprocessor operation check

Item	Condition	Operation check
1. FREQ. setting	1) ENTER push 1 2 3 4 5 push	14□.□□□ FREQ. indication : 142.345 **(K,M2)** 144.345 **(T,M1,W,X)**
	2) ENTER push 6 7 8 9 0 push	14□.□□□ FREQ. indication : 162.890 **(K,M2)** 147.890 **(M1,X)** 145.890 **(T,W)**
	3) ▼ push	5kHz DOWN (when 5kHz steps)
	4) ▲ push	5kHz UP (when 5kHz steps)
2. Function key operation (Pressing F key and numeral key activates the indicated function).	1) F 1/PRIORITY	PRIO indicator turns on. Memory channel 1 is monitored every 5 seconds PRIO indicator indicator blinks if frequency is in use.
	F 1/PRIORITY	PRIO indicator turns off.
	2) F 2/BEEP	BEEP ON (except LAMP).
	F 2/BEEP	BEEP OFF
	3) F 3/STEP	Switching of F.STEP.
	4) F 4/BAND	BAND indicator turns on. Push SCAN key to start unit scanning on all receivable frequencies.
	5) F 5/MEMORY	MEMO indicator turns on. Push SCAN key to start scan on only the memorized channel.
	6) F 6/PROGRAM	PROG indicator turns on. Push SCAN key to start scan between memory 8 and 9.
	7) F 7/SEEK	SEEK indicator turns on. Push SCAN key to start scanning. If a signal is detected stops scanning and the scanning operation is released.
	8) F 8/TIME	TIME indicator turns on. Push SCAN key to start scanning. Scanning stops if signal detected, and scanning restarts after 5 seconds.

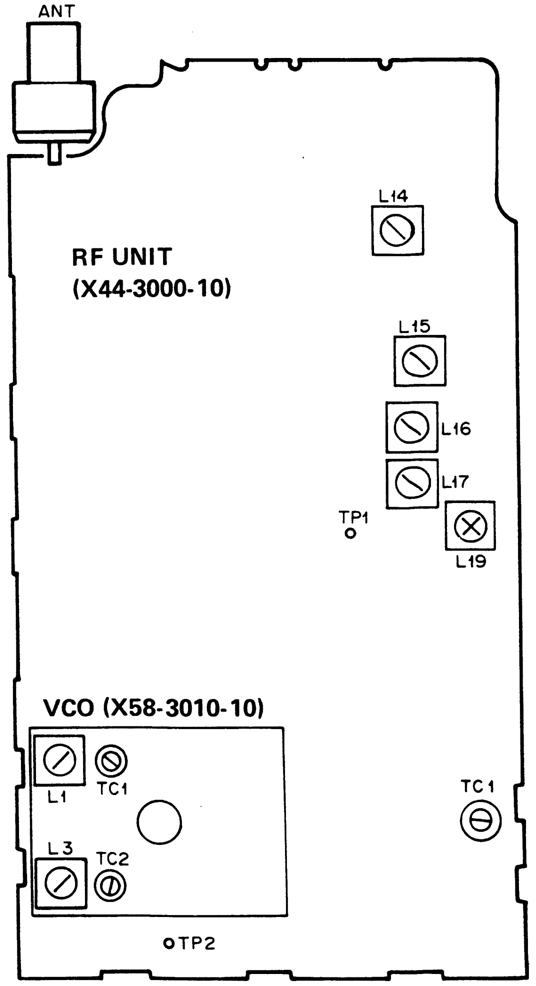
ADJUSTMENT

Item	Condition	Operation check
2. Function key operation (Pressing F key and numeral key activates the indicated function).	9) F 9/CARRIER	CAR indicator turns on. Push SCAN key to start scanning. Scanning stops if signal detected, and scanning restarts 2 seconds after the signal ends.
	10) F ▲ or ▼	High speed operation of ▼ or ▲ mode.
	11) F M/TX STOP	TX STOP indicator turns on. PTT and TONE key are disabled.
	F M/TX STOP	TX STOP indicator turns off.
	12) F ENTER/KEY LOCK	KEY LOCK indicator turns on. Disables all keys except KEY LOCK and LAMP.
	F ENTER/KEY LOCK	KEY LOCK indicator turns off.
3. OFFSET	1) OFFSET/F	→ □ → + → −
4. Memory	1) FREQ. indication : 145.020 M I push	M I indicator turns on.
	2) FREQ. indication : Any value I push	I indicator turns on. FREQ. indication : 145.020
5. BATT SAVE	1) SQ : ON	The SAVE circuit begins operation after about 2 seconds.
	2) SAVE push	
	3) F SAVE ▲ or ▼ ENTER	A rate from 1 to 9 can be selected.
6. BATT Warning	1) Unit monitors 7V from BATT pin.	BATT indicator remains off.
	2) Unit monitors 5.5V from BATT pin.	BATT indicator turns on.
7. R/TONE.F	1) R/TONE.F push push	R indicator turns on. R indicator turns off.
	2) F | R/TONE.F	
	3) Set frequency with ▲ or ▼.	
	4) ENTER push	Complete TONE frequency setting.
8. RESET	1) POWER : OFF	
	2) Hold down F ENTER POWER : ON	Unit is reset. FREQ. indication : 144.000

Adjusting points



(TOP SIDE VIEW)



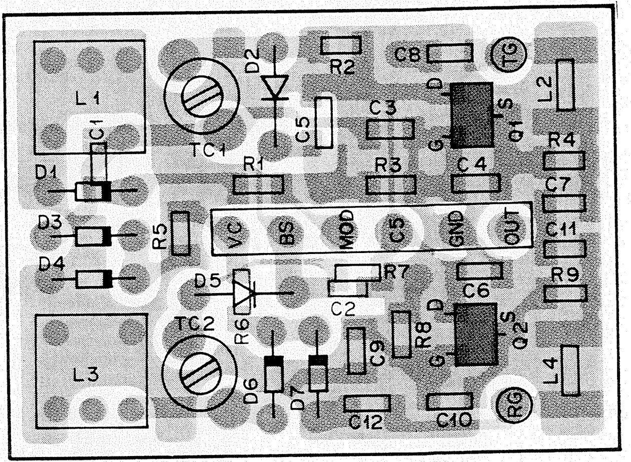
(BOTTOM SIDE VIEW)

TERMINAL FUNCTIONS/PC BOARD VIEWS TH-215A/E

Terminal functions

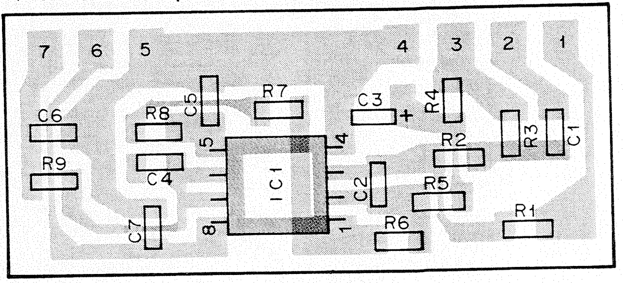
	Terminal		Terminal function
	No.	Name	
			IF/RF UNIT COMMON
	1	B	Power supply before Power switch ON.
	2	B	Power supply before Power switch ON.
	3	GND	Ground
	4	CB	Power supply after Power switch ON.
	5	CB	Power supply after Power switch ON.
	6	AFO	AF output line
	7	H/L	transmission/reception output control line
	8	T5	5V for transmission
	9	R5	5V for reception
	10	C5	5V for transmission/reception common
	11	GND	Ground
	12	MOD	Modulation signal line
	13	IF	Reception IF signal
	14	GND	Ground
	15	RST	PLL IC reset pulse
	16	SI	PLL IC serial data pulse
	17	CPS	PLL IC clock pulse
	18	UL	Unlock line, "L" : LOCK, "H" : UNLOCK
	19	SP	Signal line to internal speaker
	20	AFG	AF output line ground
	21	MIC	Signal line from Microphone
	22	IM	Signal line from internal microphone
	23	ST	Standby switch, "H" : transmission, "L" : reception
	24	M5	5V for Microphone
			RF UNIT (X44-3000-10)
	1	–	Battery (–)
	2	+	Battery (+)
			IF UNIT (X48-3020-XX)
CN2	1	TS	Tone SW ON "L"
	2	BEEP	BEEP input
	3	ST	Standby SW "L" : transmission
	4	IM	Signal line from internal MIC
	5	AFG	AF output GND
	6	SP	Signal line to internal SP
	7	UL	Unlock line, "L" : LOCK, "H" : UNLOCK
	8	CPS	PLL IC clock pulse
	9	SI	PLL IC serial data pulse
	10	RST	PLL IC reset pulse
	11	TRS	Tone IC clock pulse
	12	TDA	Tone IC data pulse
	13	TCK	Tone IC clock pulse
	14	GND	Ground
	15	SM	S meter data output
CN3	1	TCK	Tone IC clock pulse
	2	TDA	Tone IC data pulse
	3	TRS	Tone IC reset pulse
	4	TB	Power supply for external Tone unit
	5	SPO	AF output control line
	6	TI	Tone input line
	7	GND	Ground
CN4	1	SAVE	Battery save control line
	2	KEY	Power supply for key matrix
	3	VDD	Power supply for MPU
	4	TX	T5/R5 select line, "H" : transmission
	5	SQ	BUSY detect line, "H" : BUSY
	6	CB	Power supply after Power SW ON
	7	BU	Backup control line
	8	AFC	AF output control line "H" : BUSY
	9	TONE	SUB Tone signal input line
	10	DTMF	DTMF signal input line

▼ VCO (X58-3010-10) Component side view



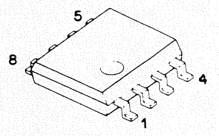
Q1,2 : 2SK302(GR)
D1,3,4,6,7 : 1SV153 D2,5 : 1SS277

▼ MIC AMP (X59-3090-10) Component side view

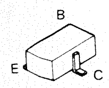


IC1 : NJM4560M

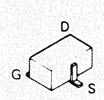
NJM4560M



2SK2412K

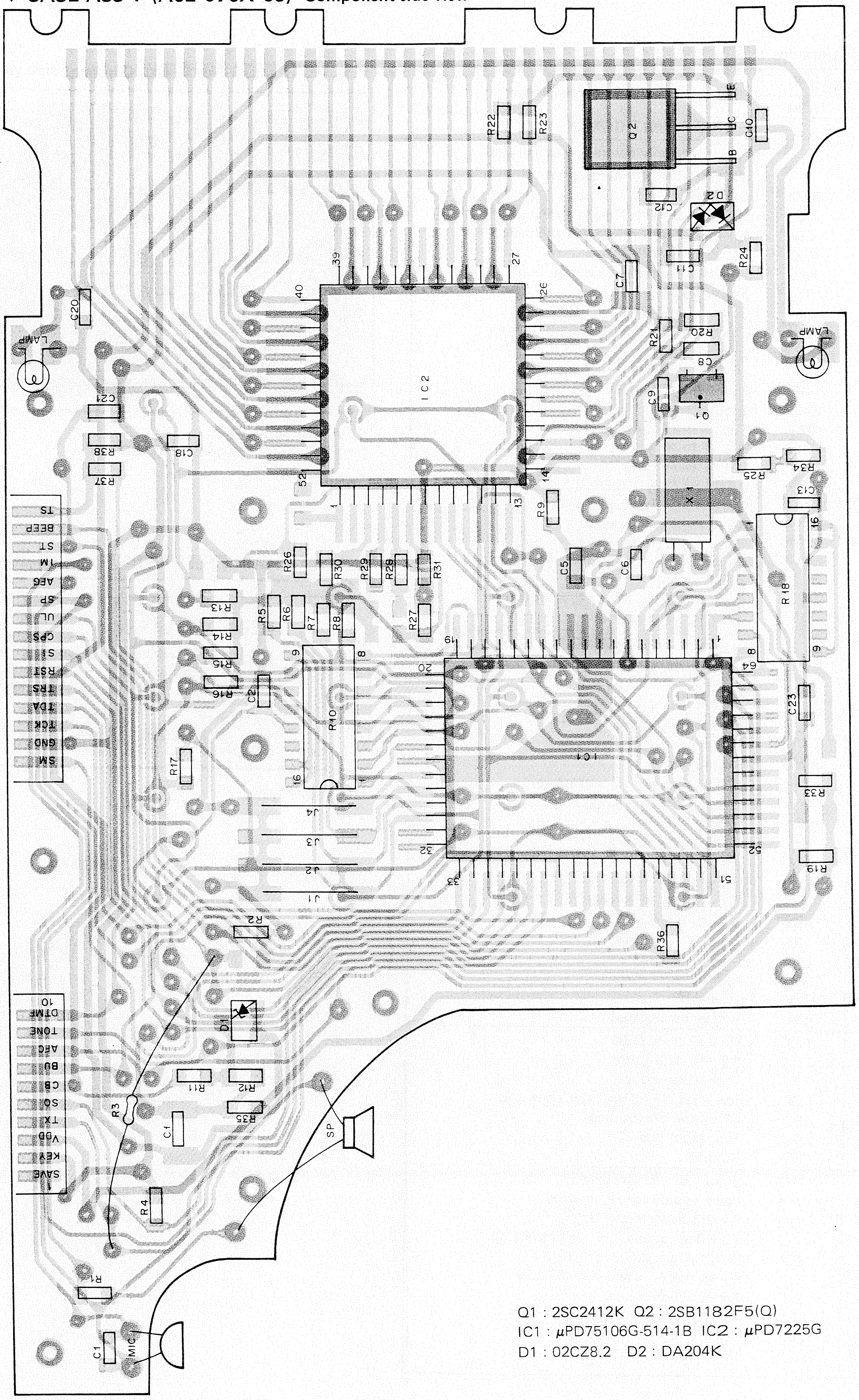


2SK302



TH-215A/E PC BOARD VIEW

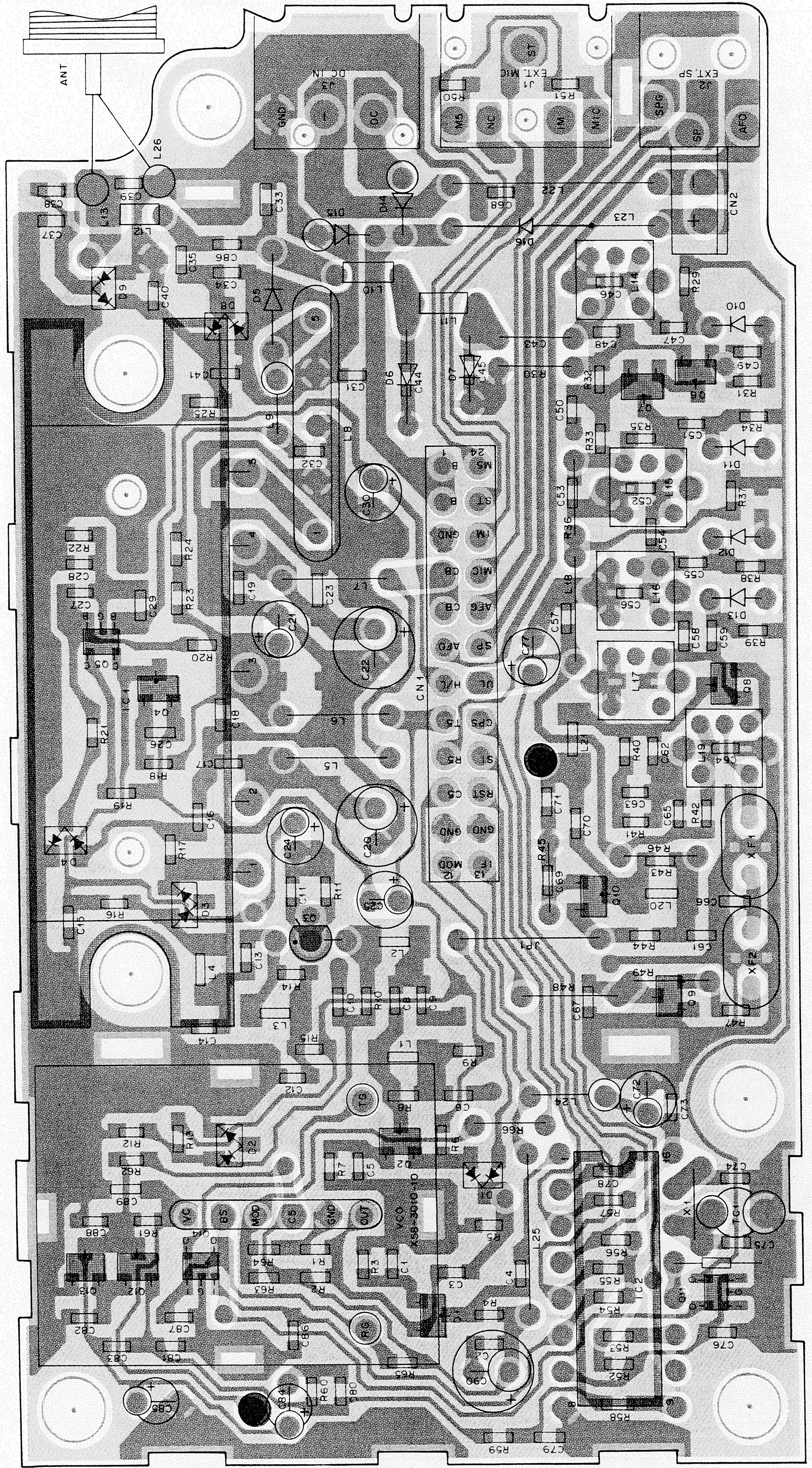
▼ CASE ASS'Y (A02-076X-05) Component side view


R22
R23
Q2
E
C
B
C10
C12
D2
C11
R24
C7
39
27
40
26
IC2
52
1
13
14
C20
LAMP
LAMP
R21
R20
C8
C9
Q1
C21
R38
C18
R37
R25
R34
C13
X1
R9
TS
BEEP
ST
IM
AFG
SP
UL
CPS
SI
RST
TRS
TDA
TCK
GND
SM
R26
R30
R29
R28
R31
C5
C6
R18
16
1
8
9
R13
R14
R15
R16
R5
R6
R7
R8
R27
19
20
1
64
C2
9
8
R10
16
IC1
C23
R17
J4
J3
J2
J1
R33
32
33
51
52
R19
R2
R36
D1
10
DTMF
TONE
AFG
BU
CB
SQ
TX
VDD
KEY
SAVE
R11
R12
R3
C1
R35
SP
R4
R1
C1
MIC

Q1 : 2SC2412K Q2 : 2SB1182F5(Q)
IC1 : μPD75106G-514-1B IC2 : μPD7225G
D1 : 02CZ8.2 D2 : DA204K

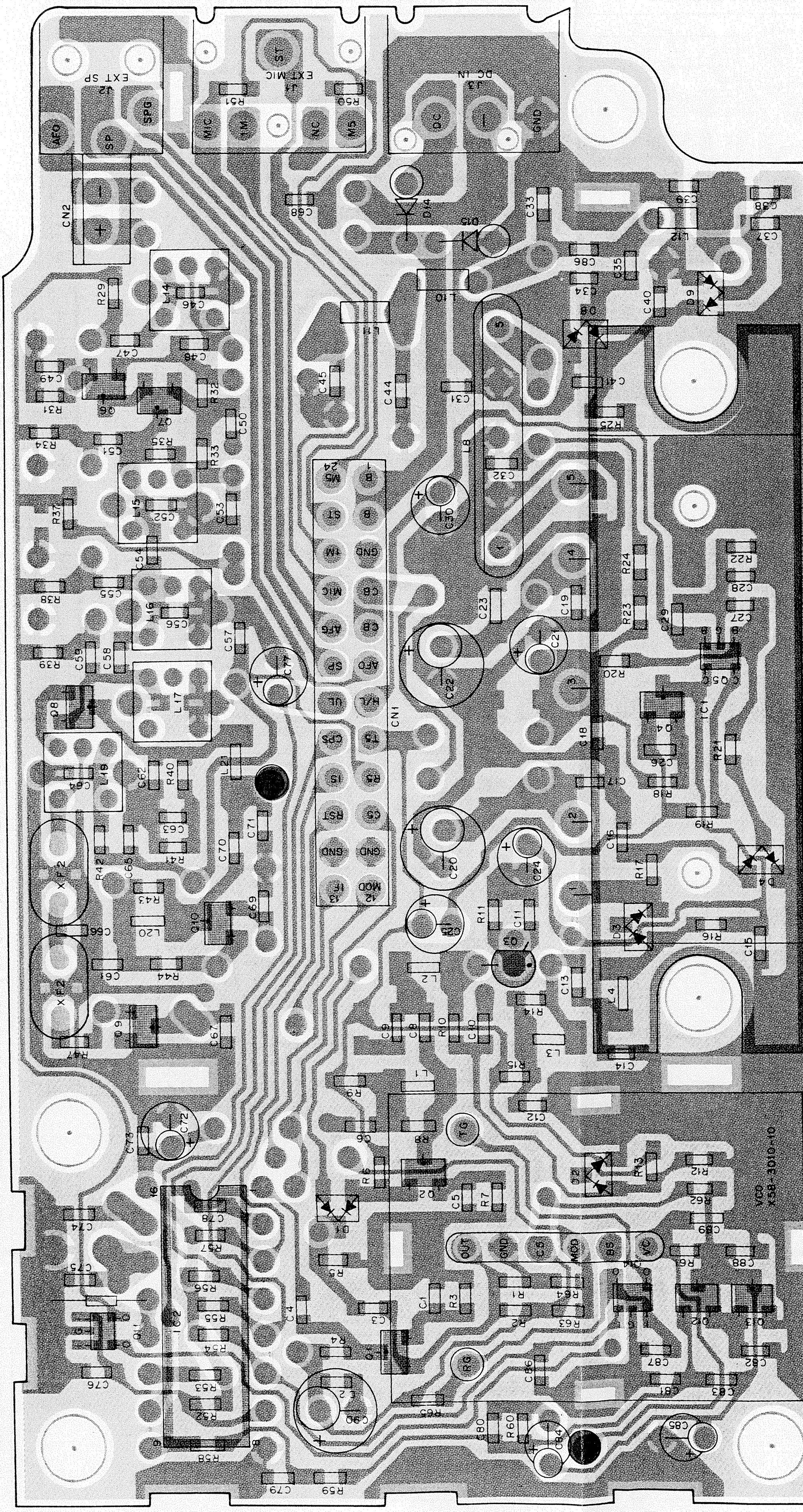
PC BOARD VIEWS TH-215A/E

▼ RF UNIT (X44-3000-10) Component side view

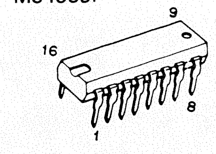

ANT
L26
DC IN J3
EXT.MIC J1
EXT.SP J2
CN1
CN2
VCO X58-3010-10

Q1,7,9 : 2SC2714(O) Q2,10 : 2SC3838K(N,P) Q3 : 2SC2407 Q4 : 2SA1313(Y) Q5 : FMW1 Q6 : 2SC3356 Q8 : 2SK210(GR) Q11,14 : FMG4 Q12,13 : 2SC2712(GR)
IC1 : M57732L IC2 : M54959P
D1 : HSM2693 D2,4 : DA204K D3 : 1SV172 D5 : MI303 D6 : MI301 D7 : 1SS277 D8,9 : HSM88AS D10–13 : 1SV153 D14,16 : ERB83-004 D15 : UZP-228

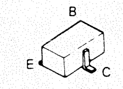
▼ RF UNIT (X44-3000-10) Foil side view


DC IN J3
EXT.MIC J1
EXT.SP J2
CN1
CN2
VCO X58-3010-10

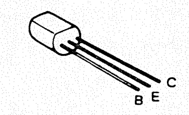
M54959P



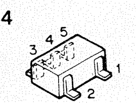
2SA1313 2SC3356
2SC2712 2SC3838K
2SC2714



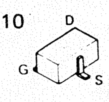
2SC2407



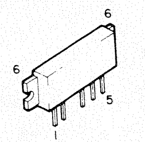
FMW1
FMG4



2SK210

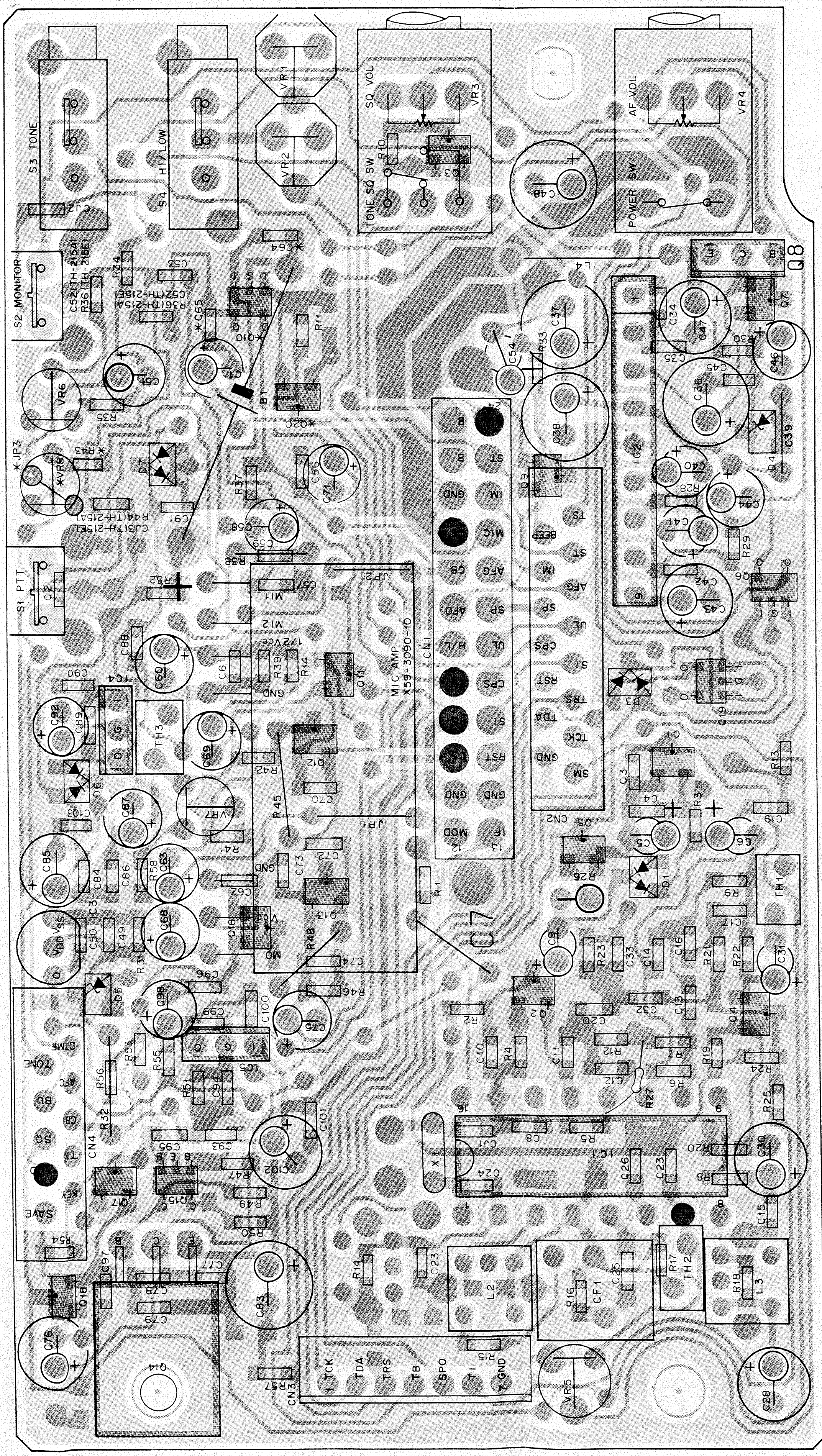


M57732L



TH-215A/E PC BOARD VIEWS

▼ IF UNIT (X48-3020-XX) Component side view -10 : TH-215A, -51 : TH-215E

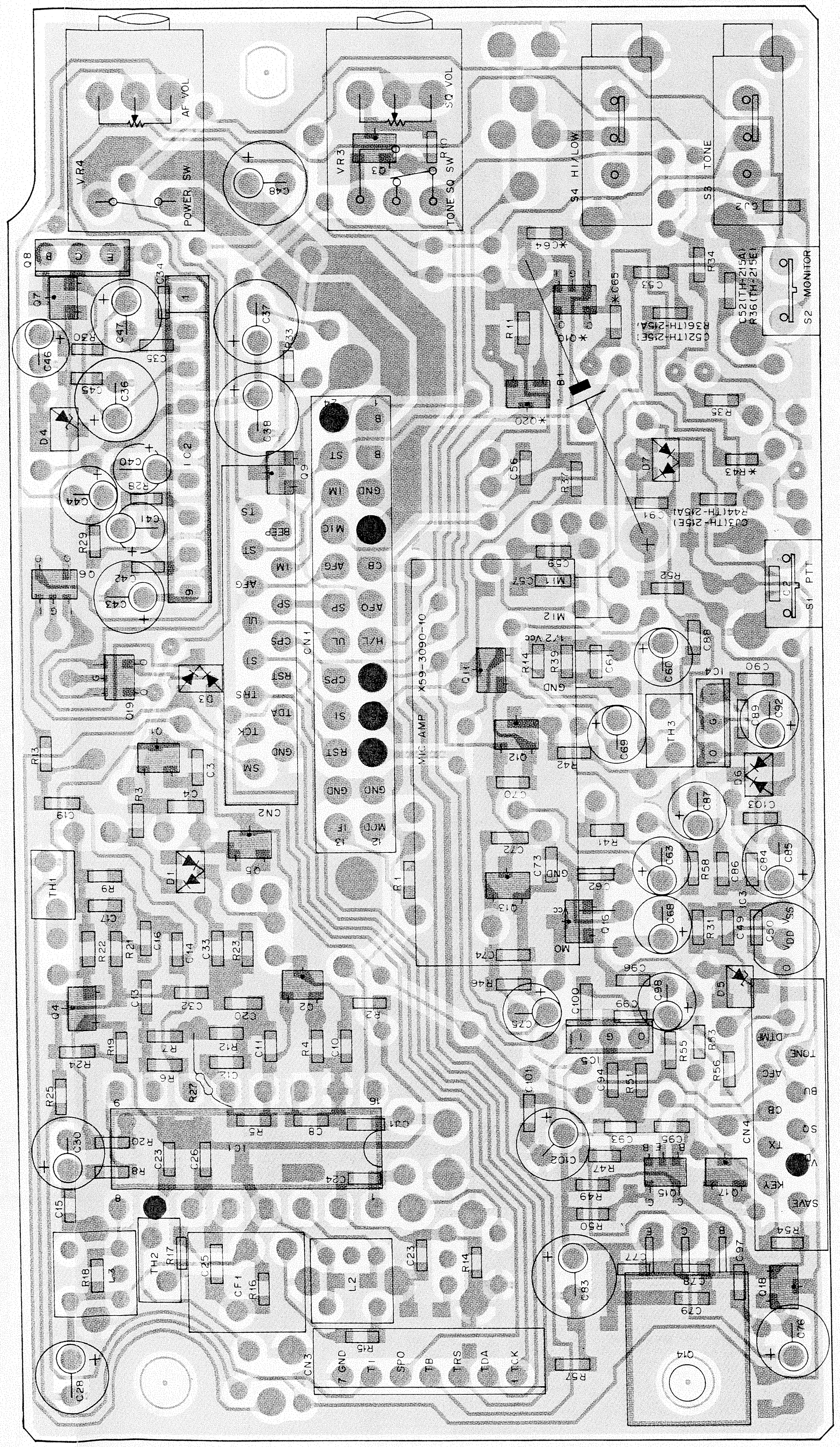


Q1,2,4,7 : 2SC2712(GR) Q3,20 : DTC144EK Q5 : 2SJ106(GR) Q6,10,19 : FMG2 Q8 : 2SA1241(Y) Q9 : DTC143XK Q11 : DTA114YK Q12 : DTA144EK
Q15 : FMW1 Q16–18 : DTC114YK Q19 : FMG2
IC1 : TA7761P IC2 : BA526 IC3 : S-8054HN IC4,5 : LVC550C
D1 : HSM88AS D3,6 : 1SS184 D4,5 : 02CZ8.2 D7 : 1SS226
TH1 : PTH59T103M TH2 : 112-202-2 TH3 : 112-101-2

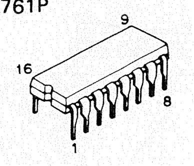
	Q10	Q20	C64	C65	R43	R44	JP3	CJ3	VR8
TH-215A (-10)	○	○	○	○	○	○	X	X	○
TH-215E (-51)	X	X	X	X	X	X	○	○	X

○ : Used, X : Not used.

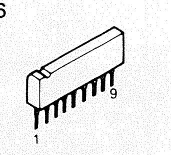
▼ IF UNIT (X48-3020-XX) Foil side view -10 : TH-215A, -51 : TH-215E



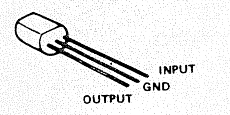
TA7761P



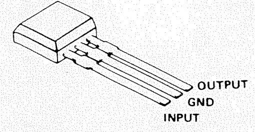
BA526



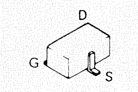
S-8054HN


INPUT
GND
OUTPUT

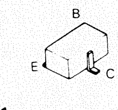
LVC550C


OUTPUT
GND
INPUT

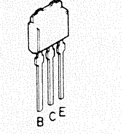
2SJ106



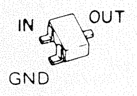
2SC2712
2SA1313



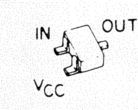
2SA1241



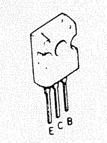
DTC114YK
DTC144EK
DTC143XK



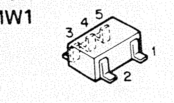
DTA114YK
DTA144EK



2SA1358

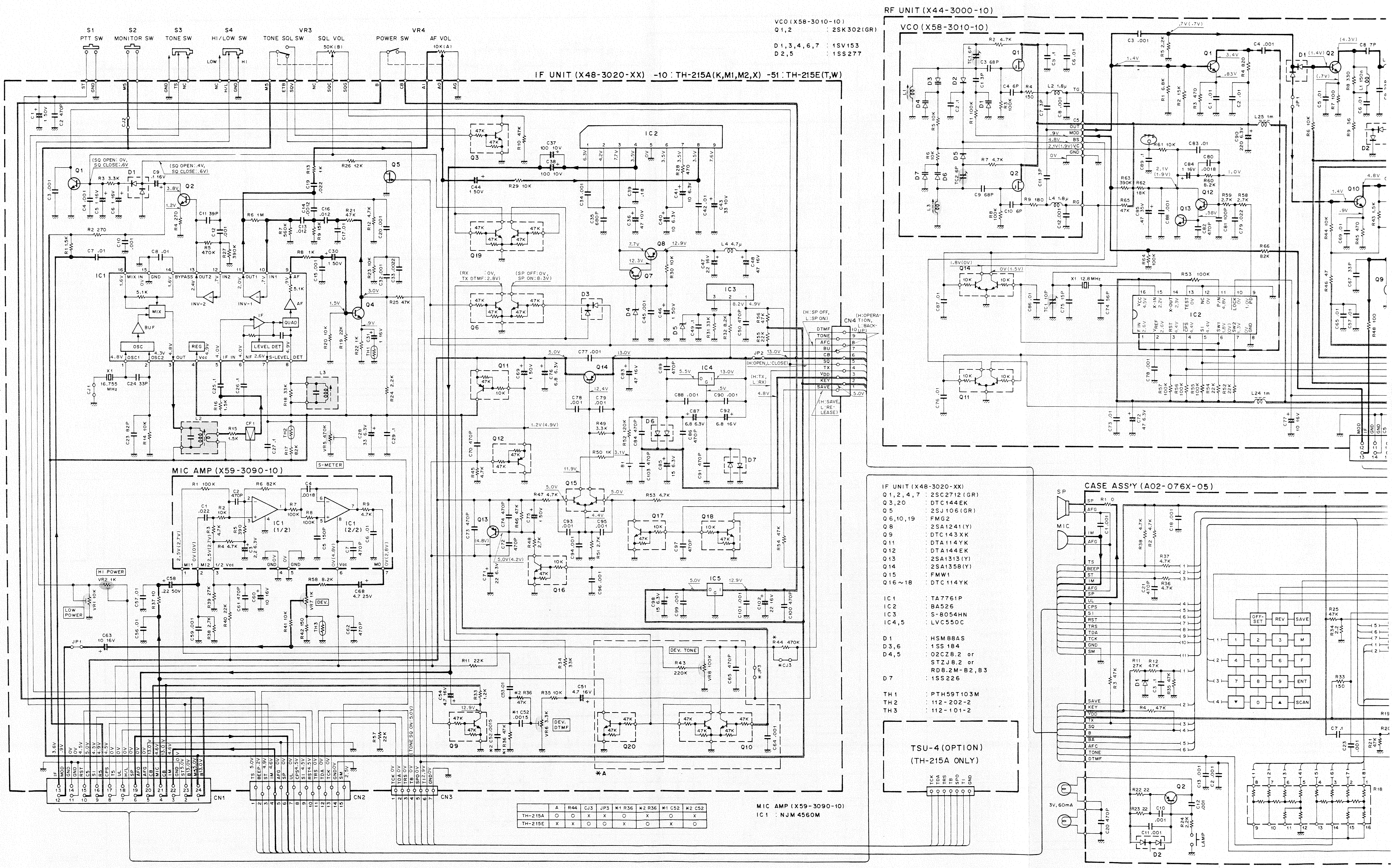


FMG2
FMW1



SCHEMATIC DIAGRAM

Signal line ——— Control line – – – – Common DC line


A B C D E F G H I J K
IF UNIT (X48-3020-XX) -10 : TH-215A(K,M1,M2,X) -51 : TH-215E(T,W)
RF UNIT (X44-3000-10)
VCO (X58-3010-10)
MIC AMP (X59-3090-10)
CASE ASS'Y (A02-076X-05)
TSU-4 (OPTION)
(TH-215A ONLY)
S1 PTT SW
S2 MONITOR SW
S3 TONE SW
S4 HI/LOW SW
VR3 TONE SQL SW SQL VOL
VR4 POWER SW AF VOL
S-METER
HI POWER
LOW POWER
DEV.
DEV. TONE
DEV. DTMF
*A
CN1
CN2
CN3
CN4
SP
MIC
LAMP

VCO (X58-3010-10)
Q1,2 : 2SK302(GR)

D1,3,4,6,7 : 1SV153
D2,5 : 1SS277

IF UNIT (X48-3020-XX)

Q1,2,4,7	2SC2712(GR)
Q3,20	DTC144EK
Q5	2SJ106(GR)
Q6,10,19	FMG2
Q8	2SA1241(Y)
Q9	DTC143XK
Q11	DTA114YK
Q12	DTA144EK
Q13	2SA1313(Y)
Q14	2SA1358(Y)
Q15	FMW1
Q16~18	DTC114YK
IC1	TA7761P
IC2	BA526
IC3	S-8054HN
IC4,5	LVC550C
D1	HSM88AS
D3,6	1SS184
D4,5	02CZ8.2 or STZJ8.2 or RD8.2M-B2,B3
D7	1SS226
TH1	PTH59T103M
TH2	112-202-2
TH3	112-101-2

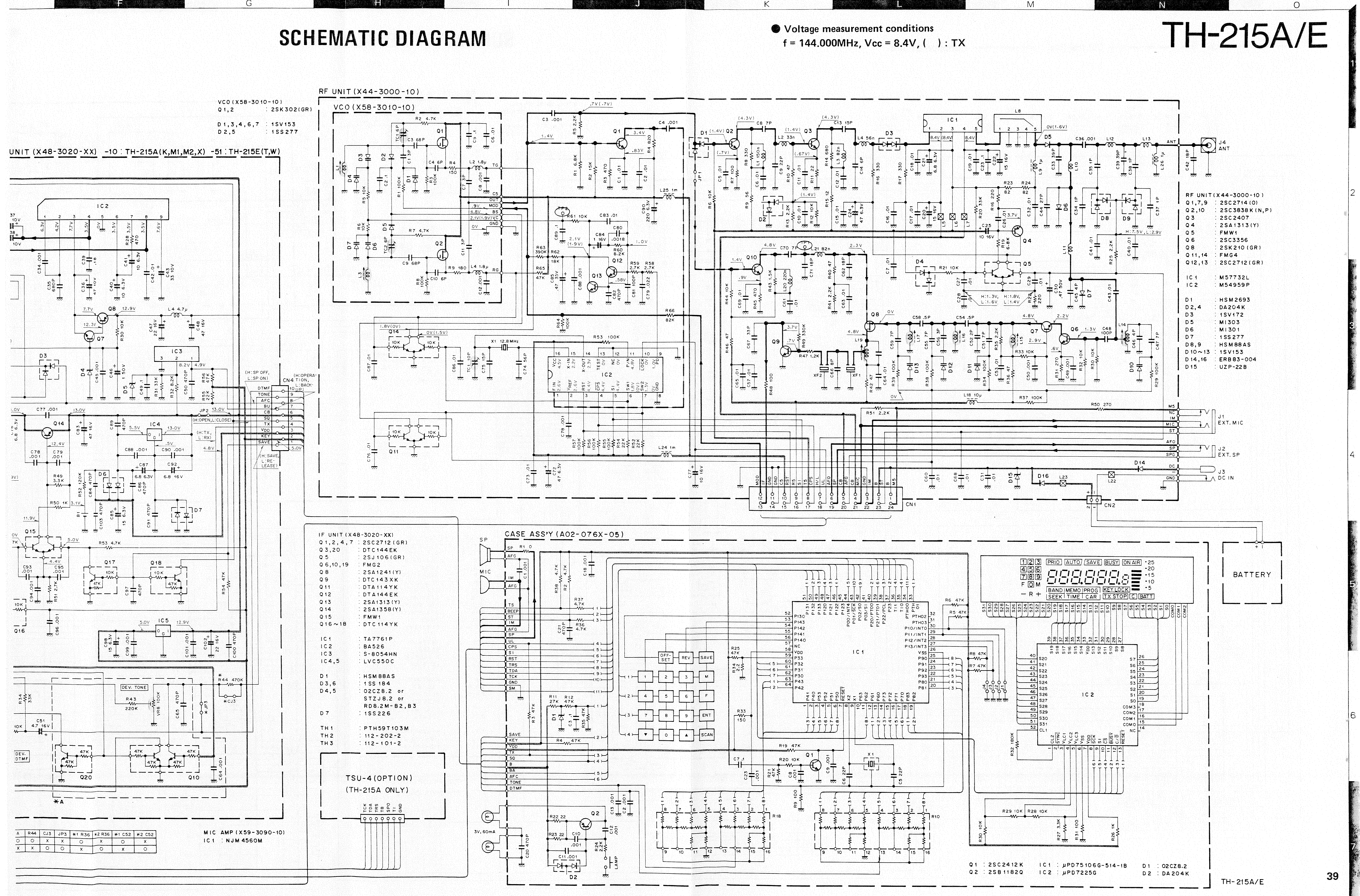
	A	R44	CJ3	JP3	*1 R36	*2 R36	*1 C52	*2 C52
TH-215A	○	○	X	X	○	X	○	X
TH-215E	X	X	○	○	X	○	X	○

MIC AMP (X59-3090-10)
IC1 : NJM4560M

SCHEMATIC DIAGRAM

● Voltage measurement conditions
f = 144.000MHz, Vcc = 8.4V, ( ) : TX

TH-215A/E


F
G
H
I
J
K
L
M
N
O
1
2
3
4
5
6
7
RF UNIT (X44-3000-10)
VCO (X58-3010-10)
UNIT (X48-3020-XX) -10 : TH-215A(K,M1,M2,X) -51 : TH-215E(T,W)
CASE ASS'Y (A02-076X-05)
TSU-4 (OPTION)
(TH-215A ONLY)
BATTERY
J1 EXT. MIC
J2 EXT. SP
J3 DC IN
J4 ANT
CN1
CN2
CN4
*A
DEV. TONE
DEV. DTMF
SP
MIC
LAMP
3V, 60mA
PRIO
AUTO
SAVE
BUSY
ON AIR
BAND
MEMO
PROG
KEY LOCK
SEEK
TIME
CAR
TX STOP
C
BATT
OFF-SET
REV
SAVE
M
F
ENT
SCAN

VCO (X58-3010-10)
Q1,2 : 2SK302(GR)

D1,3,4,6,7 : 1SV153
D2,5 : 1SS277

RF UNIT (X44-3000-10)
Q1,7,9 : 2SC2714(O)
Q2,10 : 2SC3838K(N,P)
Q3 : 2SC2407
Q4 : 2SA1313(Y)
Q5 : FMW1
Q6 : 2SC3356
Q8 : 2SK210(GR)
Q11,14 : FMG4
Q12,13 : 2SC2712(GR)

IC1 : M57732L
IC2 : M54959P

D1 : HSM2693
D2,4 : DA204K
D3 : 1SV172
D5 : MI303
D6 : MI301
D7 : 1SS277
D8,9 : HSM88AS
D10~13 : 1SV153
D14,16 : ERB83-004
D15 : UZP-22B

IF UNIT (X48-3020-XX)
Q1,2,4,7 : 2SC2712(GR)
Q3,20 : DTC144EK
Q5 : 2SJ106(GR)
Q6,10,19 : FMG2
Q8 : 2SA1241(Y)
Q9 : DTC143XK
Q11 : DTA114YK
Q12 : DTA144EK
Q13 : 2SA1313(Y)
Q14 : 2SA1358(Y)
Q15 : FMW1
Q16~18 : DTC114YK

IC1 : TA7761P
IC2 : BA526
IC3 : S-8054HN
IC4,5 : LVC550C

D1 : HSM88AS
D3,6 : 1SS184
D4,5 : 02CZ8.2 or
STZJ8.2 or
RD8.2M-B2,B3
D7 : 1SS226

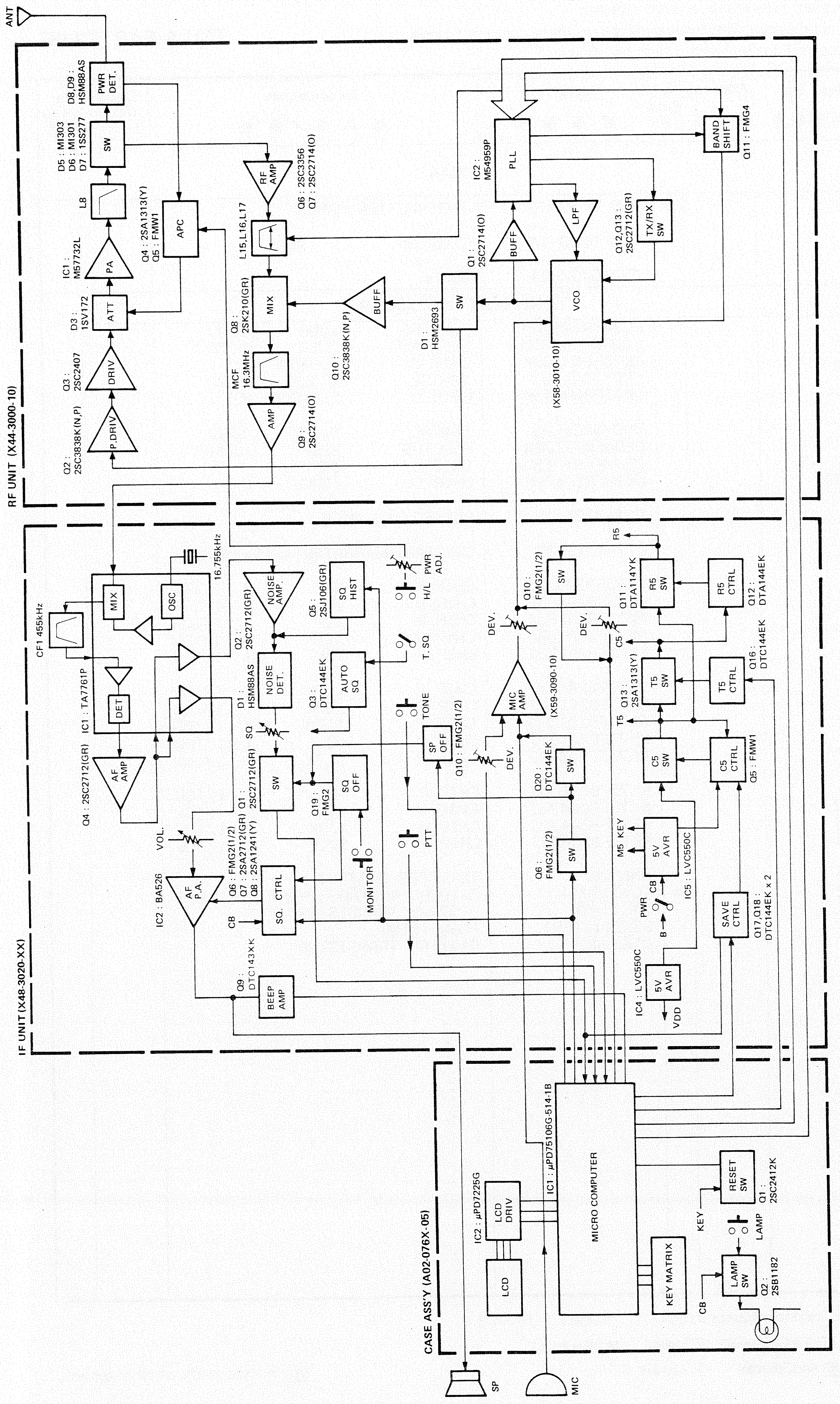
TH1 : PTH59T103M
TH2 : 112-202-2
TH3 : 112-101-2

A	R44	CJ3	JP3	*1 R36	*2 R36	*1 C52	*2 C52
○	○	X	X	○	X	○	X
X	X	○	○	X	○	X	○

MIC AMP (X59-3090-10)
IC1 : NJM4560M

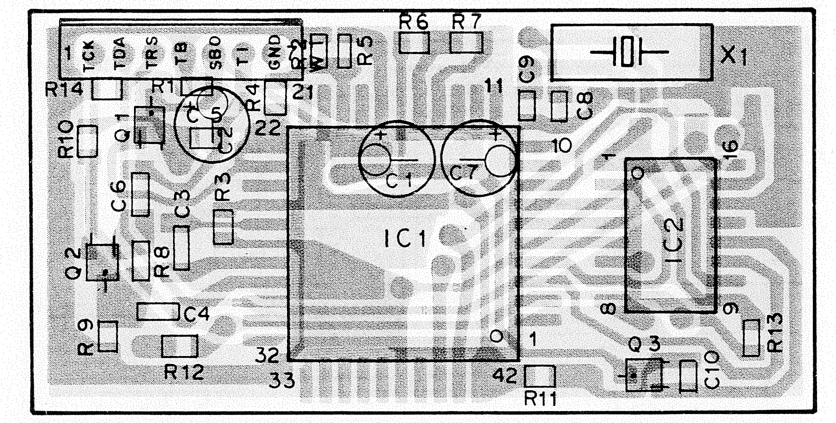
Q1 : 2SC2412K
Q2 : 2SB1182Q
IC1 : μPD75106G-514-1B
IC2 : μPD7225G
D1 : 02CZ8.2
D2 : DA204K

BLOCK DIAGRAM

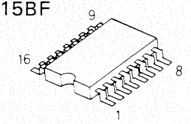

ANT
PWR DET.
D8,D9: HSM88AS
SW
D5: MI303
D6: MI301
D7: 1SS277
L8
PA
IC1: M57732L
ATT
D3: 1SV172
DRIV
Q3: 2SC2407
P.DRIV
Q2: 2SC3838K(N,P)
APC
Q4: 2SA1313(Y)
Q5: FMW1
RF AMP
Q6: 2SC3356
Q7: 2SC2714(O)
L15,L16,L17
MIX
Q8: 2SK210(GR)
MCF 16.3MHz
AMP
Q9: 2SC2714(O)
BUFF
Q10: 2SC3838K(N,P)
SW
D1: HSM2693
BUFF
Q1: 2SC2714(O)
PLL
IC2: M54959P
LPF
VCO
(X58-3010-10)
TX/RX SW
Q12,Q13: 2SC2712(GR)
BAND SHIFT
Q11: FMG4
RF UNIT (X44-3000-10)
16.755kHz
MIX
OSC
CF1 455kHz
DET
IC1: TA7761P
AF AMP
Q4: 2SC2712(GR)
NOISE AMP
Q2: 2SC2712(GR)
NOISE DET.
D1: HSM88AS
SQ HIST
Q5: 2SJ106(GR)
AUTO SQ
Q3: DTC144EK
SQ
SW
Q1: 2SC2712(GR)
SQ OFF
Q19: FMG2
VOL.
AF P.A.
IC2: BA526
SQ. CTRL
Q6: FMG2(1/2)
Q7: 2SA2712(GR)
Q8: 2SA1241(Y)
MONITOR
C8
BEEP AMP
Q9: DTC143XK
PWR ADJ.
H/L
T. SQ
TONE
SP OFF
Q10: FMG2(1/2)
PTT
MIC AMP
(X59-3090-10)
DEV.
Q20: DTC144EK
SW
Q6: FMG2(1/2)
Q10: FMG2(1/2)
R5
R5 SW
Q11: DTA114YK
R5 CTRL
Q12: DTA144EK
C5
T5 SW
Q13: 2SA1313(Y)
T5 CTRL
Q16: DTC144EK
T5
C5 SW
C5 CTRL
Q5: FMW1
M5 KEY
5V AVR
IC5: LVC550C
C8
PWR
B
SAVE CTRL
Q17,Q18: DTC144EK x 2
5V AVR
IC4: LVC550C
VDD
IF UNIT (X48-3020-XX)
MICRO COMPUTER
IC1: μPD7506G-514-1B
LCD DRIV
IC2: μPD7225G
LCD
RESET SW
Q1: 2SC2412K
KEY
LAMP
KEY MATRIX
LAMP SW
Q2: 2SB1182
CASE ASS'Y (A02-076X-05)
SP
MIC

TSU-4 (TONE SQUELCH : TH-215A ONLY)

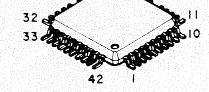
TSU-4 PC BOARD VIEW


1
TCK
TDA
TRS
TB
SBO
TI
GND
W1
R2
R5
R6
R7
X1
R14
R1
R4
21
22
11
C9
C8
10
1
16
R10
Q1
C5
C2
C6
C3
R3
C1
C7
IC1
IC2
Q2
R8
C4
8
9
R9
R12
32
33
1
42
R11
Q3
C10
R13

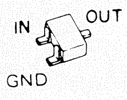
TC4015BF



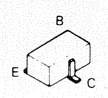
MN6520


22
21
32
33
11
10
42
1

DTC114YK
DTC144EK

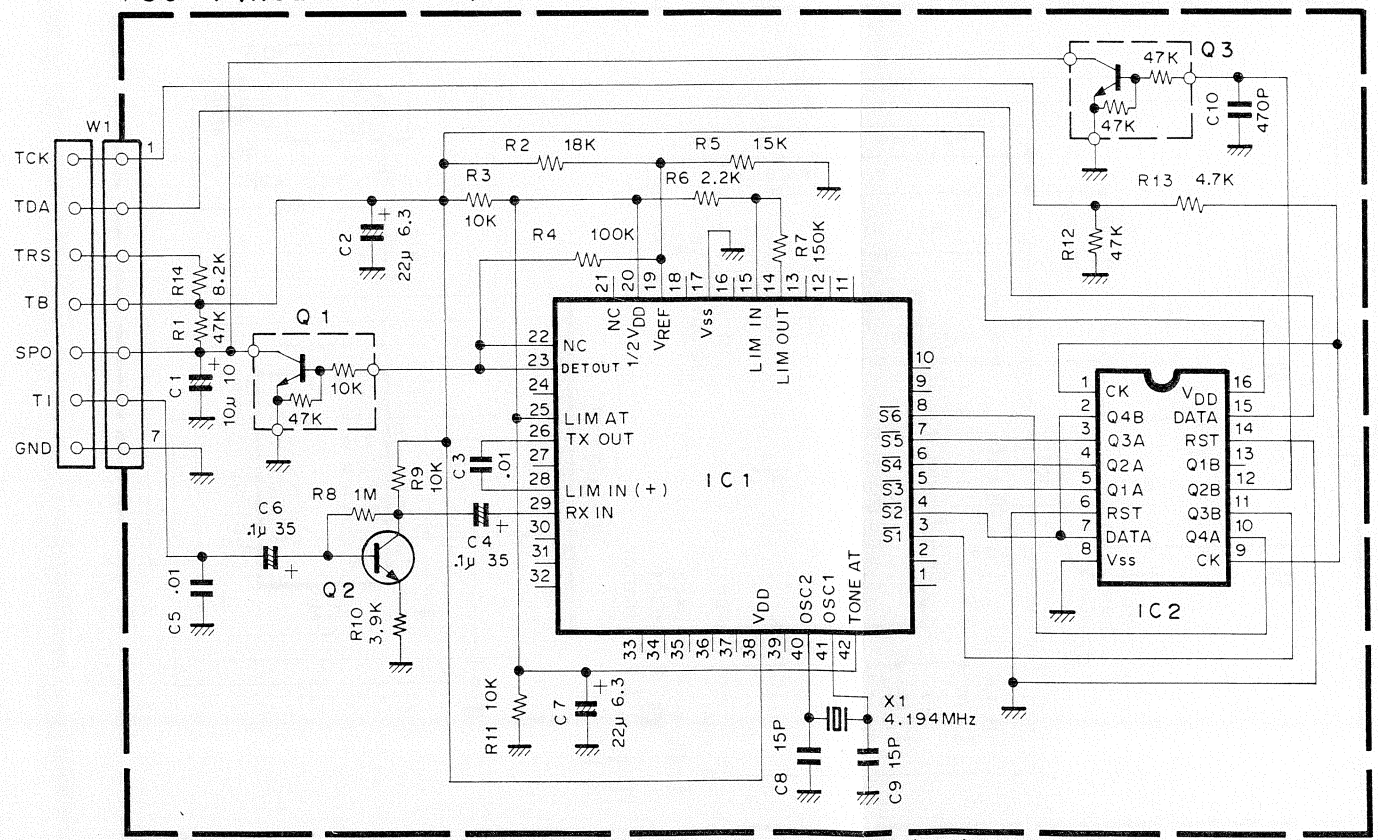


2SC2712



TSU-4 CIRCUIT DIAGRAM

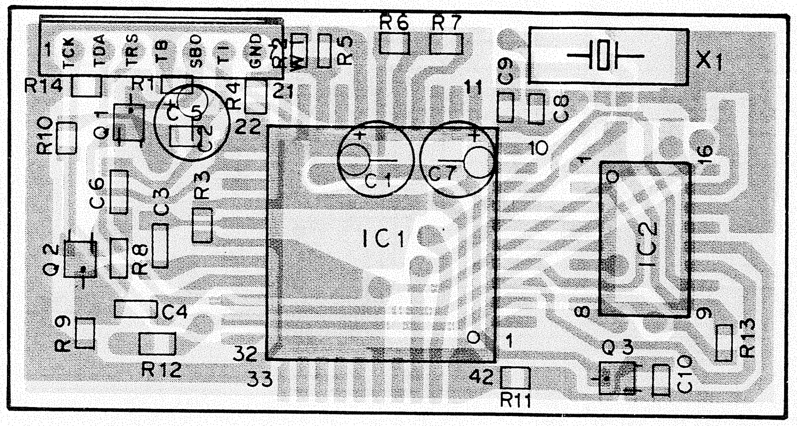
TSU-4 (X52-3040-00)


W1
TCK
TDA
TRS
TB
SPO
TI
GND
1
7
R2 18K
R5 15K
R3 10K
R6 2.2K
R4 100K
R7 150K
C2 22μ 6.3
R14 8.2K
R1 47K
C1 10μ 10
Q1
10K
47K
C6 .1μ 35
R8 1M
R9 10K
C3 .01
C4 .1μ 35
C5 .01
Q2
R10 3.9K
R11 10K
C7 22μ 6.3
C8 15P
C9 15P
X1 4.194MHz
NC
DETOUT
LIM AT
TX OUT
LIM IN (+)
RX IN
NC
1/2VDD
VREF
Vss
LIM IN
LIM OUT
VDD
OSC2
OSC1
TONE AT
S6
S5
S4
S3
S2
S1
IC1
Q3
47K
47K
C10 470P
R13 4.7K
R12 47K
CK
VDD
Q4B
DATA
Q3A
RST
Q2A
Q1B
Q1A
Q2B
RST
Q3B
DATA
Q4A
Vss
CK
IC2

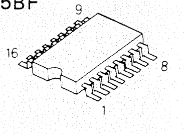
IC1: MN6520 IC2: TC4015BF Q1: DTC114YK Q2: 2SC2712(GR) Q3: DTC144EK

TSU-4 (TONE SQUELCH : TH-215A ONLY)

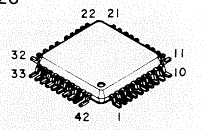
TSU-4 PC BOARD VIEW


TCK
TDA
TRS
TB
SBO
TI
GND
W1
R6
R7
R5
R14
R1
R10
Q1
C1
C2
R4
21
22
11
C9
C8
X1
10
1
16
C1
C7
C6
C3
R3
IC1
IC2
Q2
R8
R9
C4
8
9
R13
32
33
1
Q3
C10
R12
42
R11

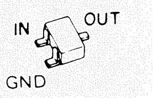
TC4015BF



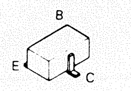
MN6520


22
21
32
33
11
10
42
1

DTC114YK
DTC144EK

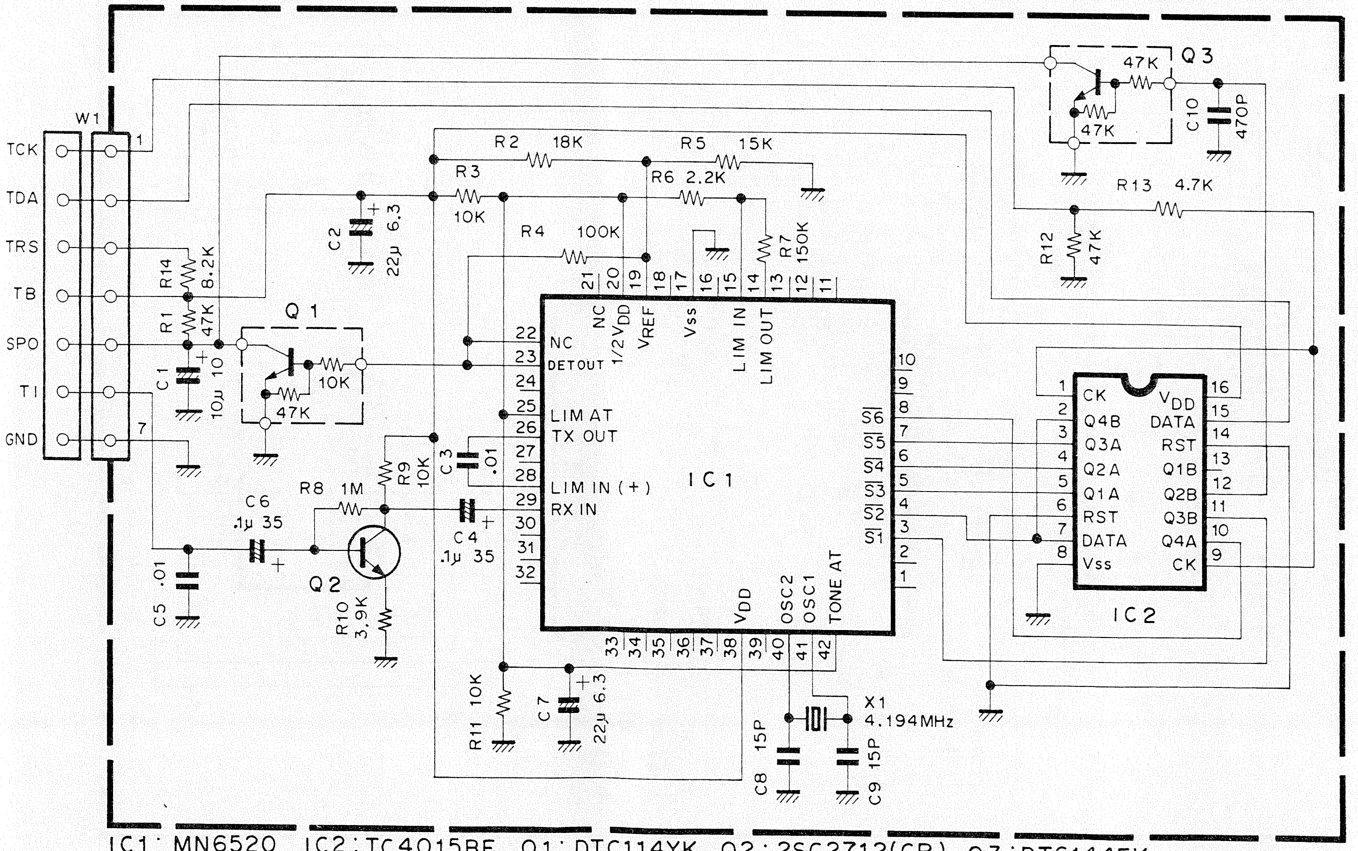


2SC2712



TSU-4 CIRCUIT DIAGRAM

TSU-4 (X52-3040-00)


W1
TCK
TDA
TRS
TB
SPO
TI
GND
1
7
R14 8.2K
R1 47K
C1 10μ 10
C2 22μ 6.3
Q1
10K
47K
R2 18K
R3 10K
R4 100K
R5 15K
R6 2.2K
R7 150K
C6 .1μ 35
R8 1M
R9 10K
C3 .01
C4 .1μ 35
C5 .01
Q2
R10 3.9K
IC1
NC
DETOUT
LIM AT TX OUT
LIM IN (+)
RX IN
1/2VDD
VREF
Vss
LIM IN
LIM OUT
VDD
OSC2
OSC1
TONE AT
S6
S5
S4
S3
S2
S1
R11 10K
C7 22μ 6.3
C8 15P
C9 15P
X1 4.194MHz
IC2
CK
VDD
Q4B
DATA
Q3A
RST
Q2A
Q1B
Q1A
Q2B
RST
Q3B
DATA
Q4A
Vss
CK
Q3
47K
47K
C10 470P
R13 4.7K
R12 47K

IC1: MN6520 IC2: TC4015BF Q1: DTC114YK Q2: 2SC2712(GR) Q3: DTC144EK

TSU-4 (TONE SQUELCH : TH-215A ONLY)

⁎ New Parts

Parts without Parts No. are not supplied.
Les articles non mentionnes dans le Parts No. ne sont pas fournis.
Teile ohne Parts No. werden nicht geliefert.

TSU-4 PARTS LIST

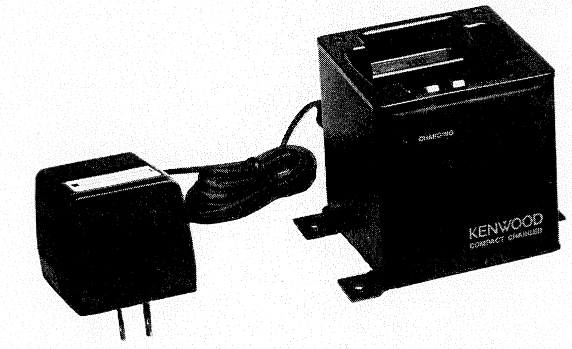
Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Desti-nation 仕向	Re-marks 備考
TSU-4						
-		⁎	B50-8130-00	INSTRUCTION MANUAL		
-			G13-0820-14	CUSHION (ACSY)		
-			J90-0402-04	GUIDE		
TONE UNIT (X52-3040-00)						
C1			CE04CW1A100M	ELECTRO 10UF 10WV		
C2			CE04CW0J220M	ELECTRO 22UF 6.3WV		
C3			CK73EB1H103K	CHIP C 0.010UF K		
C4			C92-0001-05	TANTAL 0.1UF 35WV		
C5			CK73FB1H103K	CHIP C 0.010UF K		
C6			C92-0001-05	TANTAL 0.1UF 35WV		
C7			CE04CW0J220M	ELECTRO 22UF 6.3WV		
C8 ,9			CC73FCH1H150J	CHIP C 15PF J		
C10			CK73FB1H471K	CHIP C 470PF K		
W1			E31-3223-15	CONNECTING WIRE		
X1			L77-1313-05	CRYSTAL RESONATOR(4.194394MHZ)		
R1			RK73FB2A473J	CHIP R 47K J 1/10W		
R2			RK73FB2A183J	CHIP R 18K J 1/10W		
R3			RK73FB2A103J	CHIP R 10K J 1/10W		
R4			RK73FB2A104J	CHIP R 100K J 1/10W		
R5			RK73FB2A153J	CHIP R 15K J 1/10W		
R6			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R7			RK73FB2A154J	CHIP R 150K J 1/10W		
R8			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R9			RK73FB2A103J	CHIP R 10K J 1/10W		
R10			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R11			RK73FB2A103J	CHIP R 10K J 1/10W		
R12			RK73FB2A473J	CHIP R 47K J 1/10W		
R13			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R14			RK73FB2A822J	CHIP R 8.2K J 1/10W		
IC1			MN6520	IC(CTCSS SYSTEM)		
IC2		⁎	TC4015BF	IC(DUAL 4-STAGE SHIFT RESISTOR		
Q1			DTC114YK	DIGITAL TRANSISTOR		
Q2			2SC2712(GR)	TRANSISTOR		
Q3			DTC144EK	DIGITAL TRANSISTOR		

E: Scandinavia & Europe K: USA P: Canada W: Europe
U: PX(Far East, Hawaii) T: England M: Other Areas
UE: AAFES(Europe) X: Australia

⚠ indicates safety critical components.

BC-8 (COMPACT CHARGER)

BC-8 EXTERNAL VIEW

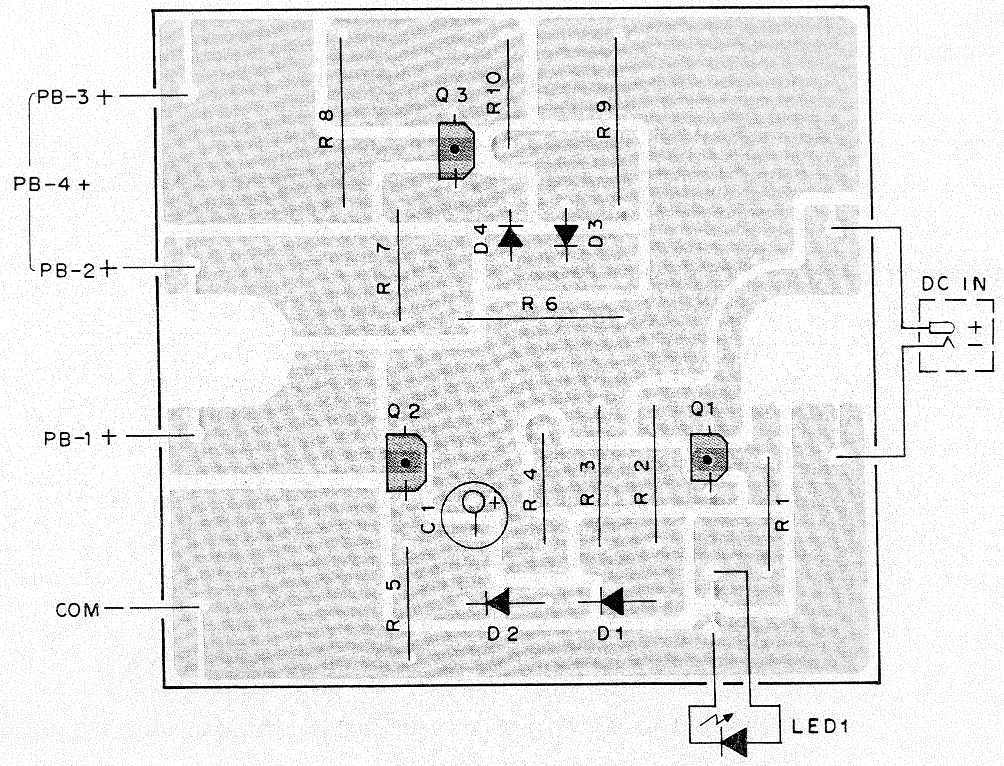

KENWOOD
COMPACT CHARGER

BC-8 PARTS LIST

N : New parts

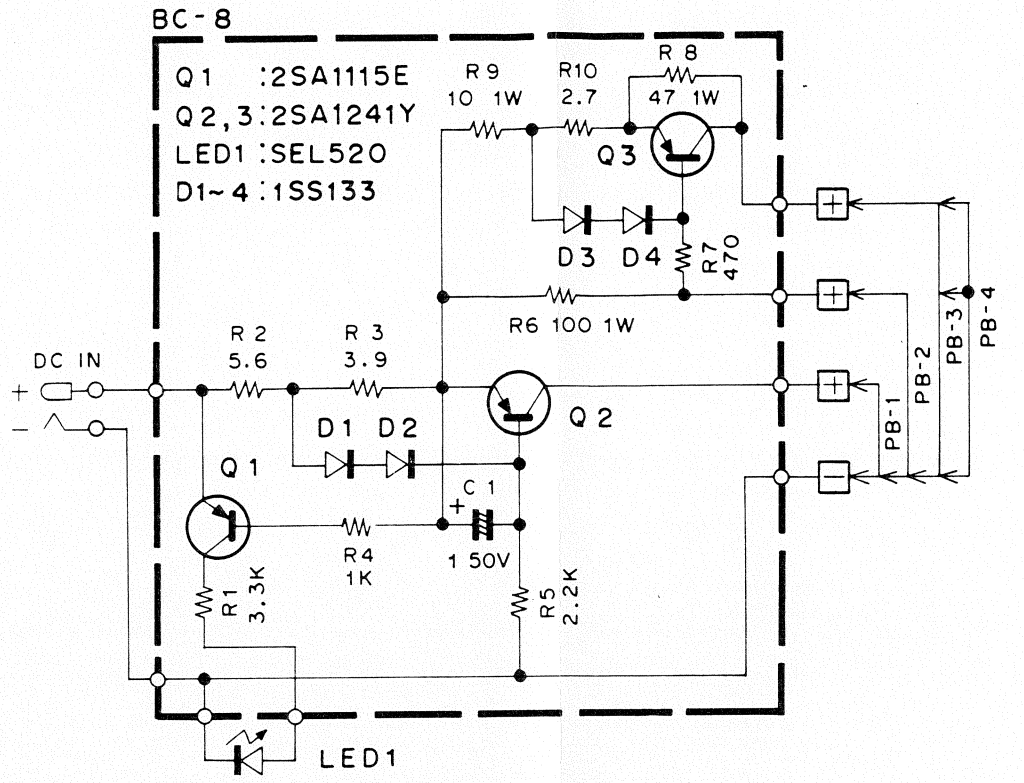
Parts No.	Re-marks	Description	Ref.No.
A02-0778-05	N	Case	
B50-8137-18	N	Instruction manual	
W09-0391-08	N	PC board ass'y	
2SA1115E		TR	Q1
2SA1241Y		TR	Q2,3
1SS133		Diode	D1~4
SEL520		LED	LED1

BC-8 PC BOARD VIEW

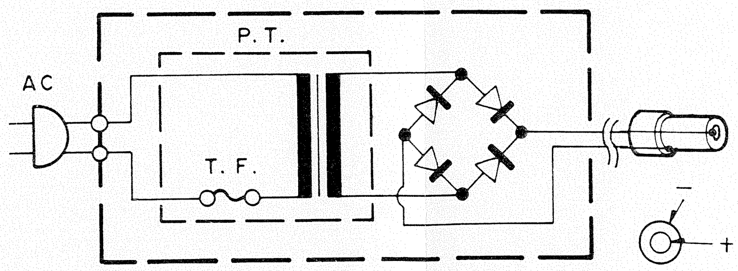

PB-3 +
PB-4 +
PB-2+
PB-1 +
COM
R 8
Q 3
R 10
R 9
D4
D3
R 7
R 6
DC IN
+
−
Q 2
Q1
C 1
R 4
R 3
R 2
R 1
R 5
D 2
D1
LED1

BC-8 (COMPACT CHARGER)

BC-8 CIRCUIT DIAGRAM


BC-8
Q1 :2SA1115E
Q2,3:2SA1241Y
LED1 :SEL520
D1~4 :1SS133
R9 10 1W
R10 2.7
R 8 47 1W
Q3
D3 D4
R7 470
R6 100 1W
R 2 5.6
R 3 3.9
DC IN
+
−
Q 2
D1 D2
Q 1
C 1
1 50V
R4 1K
R1 3.3K
R5 2.2K
LED1
PB-1
PB-2
PB-3
PB-4

The unspecified resistors have the value of 1/4W.



SPECIFICATIONS

General

Frequency range	144.00MHz – 148.00MHz (TH-215A) 144.00MHz – 146.00MHz (TH-215E)
Signal type	F3 (F3E)
Power supply voltage	DC 6.3V – 15V (Battery terminal) DC 7.2V – 16V (DC IN jack)
Power consumption	At reception standby ; Approx. 50mA At battery power save ; Approx. 11mA At transmission (5W) ; Less than 1.7A At transmission (0.5W) ; Less than 0.7A
Antenna impedance	50Ω
EXT. MIC impedance	2kΩ
Operating temperature	–20°C – +50°C
Dimensions	67 (69.5) W x 173 (180.7) H x 37 (40) D mm The numbers in the parenthesis include projections parts.
Weight	540g (including antenna and Ni-Cd batteries)

Transmitter section

Output power	Hi ; 5W, Low ; 0.5W
Modulation system	Reactance modulation
Max. frequency deviation	±5kHz
Unwanted reflection	Less than –60dB
Frequency tolerance	Less than $\pm 20 \times 10^{-6}$ (–10°C ~ +50°C)

Receiver section

Reception system	Double superheterodyne
Intermediate frequency	1st IF ; 16.3MHz 2nd IF ; 455kHz
Sensitivity	12dB SINAD ; 0.2μV
Squelch sensitivity	Less than 0.1μV
Selectivity	–6dB at more than 12kHz, –40dB at more than 24kHz
AF output	More than 350mW (8Ω load, distortion 10%)

Design and specifications subject to change without notice.